Homathko Development

Generation
Engineering Overview Study

B.C. Hydro
Hydroelectric Generation Projects Division

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HYDROELECTRIC DEVELOPMENT OF THE HOMATHKO RIVER

OVERVIEW STUDY

HYDROELECTRIC GENERATION PROJECTS DIVISION

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HYDROELECTRIC DEVELOPMENT OF THE HOMATHKO RIVER

OVERVIEW STUDY

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SYNOPSIS

Two alternative schemes of development have been studied.

Scheme 1 is a basic development without any flow diversion, and comprises the following four projects:

Tatlayoko Storage	-	storage of the upper Homathko River flows
Mosley Creek	-	storage of the tributary Mosley Creek flows, and power generation
Nude Canyon and Waddington	-	power generation on the mainstem Homathko River

Scheme 2 comprises the above four projects, with increased generating capacity at the Nude Canyon and Waddington projects, in conjunction with the complete diversion of Taseko Lake water from the Fraser River watershed to Tatlayoko Lake. This diversion would include a powerplant located on Tatlayoko Lake. An additional generation project, designated as Bowl Lake, has also been studied in conjunction with Taseko Diversion to develop the remaining head between the Nude Canyon reservoir and Tatlayoko Lake.

Partial diversion of water from Chilko Lake, also on the headwaters of the Fraser River, was not considered in detail due to the lake's importance to the Fraser River salmon fishery.

Comparative power and cost information for the two development schemes, in terms of October 1980 dollars, are summarized as follows:

REPORT

Project	Installed Capacity (MW)	Average Energy (Avg. MW)	Capital Cost ($ x 10^6)	Capacity Cost ($/kW)	Energy Cost ($/Avg. kW)	Capacity Factor (%)
Scheme 1 (Non-diversion)						
Tatlayoko Storage	-	-	27.1	-	-	-
Nude Canyon	240	144	394.5	1644	2740	60
Mosley Creek	300	181	421.5	1405	2329	60
Waddington	360	219	378.0	1050	1726	60
TOTAL Scheme 1	900	544	1221.1	1357	2245	60
Scheme 2 (Taseko Diversion)						
Tatlayoko Storage	-	-	27.1	-	-	-
Nude Canyon	500	300	461.3	923	1538	60
Mosley Canyon	300	181	421.5	1405	2329	60
Waddington	495	296	415.4	839	1403	60
Taseko-Tatlayoko Diversion	175	132	398.8	2279	3021	75
TOTAL Scheme 2	1470	909	1724.1	1173	1897	62
Bowl Lake (Optional) Power Facilities	75	44	135.6	1808	3082	59
TOTAL Scheme 2 with Bowl Lake Project	1545	953	1859.7	1204	1951	62

For Scheme 2, the best sequence of development would entail completion of the Nude Canyon Project in conjunction with the Taseko-Tatlayoko Diversion Project and the Tatlayoko Storage Project. Next in sequence, the Waddington Project should be completed in conjunction with, or closely following, development of the Mosley Creek Project. The Bowl Lake Project would be completed as the last element of Scheme 2 if found to be economic.

For Scheme 1, the Waddington Project would probably be developed in conjunction with, or closely following, the Mosley Creek Project and the Tatlayoko Storage Project. Due to its comparatively high cost of power, the Nude Canyon Project would be the last element in Scheme 1 to be completed.

The Construction periods from first contract award to first in-service date on 1 October of a given year are estimated to be as follows:

Project	Construction Period (Years)
Tatlayoko Storage	2 1/2
Nude Canyon	6 3/4
Mosley Creek	5 3/4
Waddington	6 3/4
Taseko-Tatlayoko Diversion	4 3/4
Bowl Lake	4 3/4

It is recommended that, if a decision is made to proceed with feasibility studies, investigations concentrate initially on Scheme 1, the basic four dam scheme with no diversion of Taseko water. An environmental impact study of the Taseko diversion should be made to establish the environmental feasibility and cost of diversion. Some downstream flow release from Taseko Lake for fishery purposes may be required. Accordingly, the economics of reduced Taseko Lake flows should also be investigated. Mitigation of any environmental and social impacts of the Taseko diversion should be studied by a multi-disciplinary team, with emphasis on minimizing the impact of flow conveyance on Indians living on or near the four reserves through which water would be diverted.

The Bowl Lake Project should be investigated to a level comparable to that for the Scheme 2 projects.

SECTION 1.0 - INTRODUCTION

1.1 TERMS OF REFERENCE

The Hydroelectric Design Division (HEDD) was authorized to provide engineering services for an overview study of the hydroelectric development of the Homathko River under Assignment 476-079.

1.2 SCOPE OF WORK

As set out in the Engineering Assignment, alternatives were to be assessed relative to reducing impacts on the Chilko Lake and Taseko Lake salmon fisheries. In particular, consideration was to be given to the following alternatives, in order of reducing impact on the salmon fisheries:

1. Diversion of both Taseko Lake and Chilko Lake water.

2. Diversion of Taseko Lake water only (Scheme 2).

3. No flow diversions (Scheme 1).

1.3 BACKGROUND

The Homathko River has been studied for potential hydro development over many years. In 1957 the British Columbia Power Commission prepared a preliminary report on hydroelectric potential of the Homathko system. In 1958 the Commission retained a joint venture, Sandwell International Ltd. of Vancouver and Electro-Watt of Zurich to undertake an engineering feasibility study of the Homathko River.

During the course of this study, eight alternative schemes of development were considered. The feasibility report was issued in

1.3 BACKGROUND - (Cont'd)

1959 and it was concluded therein that principal projects at the Mosley Creek and Waddington Canyon sites, including a storage dam at the outlet of Tatlayoko Lake, were feasible (see Plate 2-1). Developments at the Nude Canyon and Shelter Canyon sites were also studied, but in much less detail than the above principal projects which were recommended for further detailed investigations.

Further study of the Homathko River was conducted for the B.C. Energy Board Provincial Study in 1971/72. For this study, the scheme of development comprised two mainstem Homathko River projects, Nude Canyon and Waddington; the storage and power project on the tributary, Mosley Creek; the storage project on Tatlayoko Lake; and partial diversion of flows from Taseko and Chilko lakes, on the headwaters of the Fraser River drainage, to Tatlayoko Lake via a powerplant located on the shoreline of this lake. With this scheme, head development would have been 890, 600 and 1490 feet for the Nude Canyon, Waddington and Mosley projects, respectively. For the Taseko-Chilko-Tatlayoko diversion project, effectively 93 and 29 percent of the outflows from Taseko and Chilko lakes (a total of 2000 cfs including local runoff between these lakes) would have been diverted and passed through an average gross head of 1210 feet to the Tatlayoko Lake powerplant, and then passed through an additional gross head of 1490 feet at the Nude and Waddington projects.

The cost estimates for the project arrangements developed for the B.C. Energy Board were updated in mid-1976 by the Hydroelectric Design Division (HEDD) of B.C. Hydro, as part of a planning study of conventional future electric energy sources. In addition, recognizing concerns over the impact of modifying inflows to and outflows from Chilko Lake on the important salmon fishery of the Chilko River system, a new scheme involving no diversion of Chilko Lake flows, but complete diversion of Taseko Lake flows (including local runoff between Taseko and Chilko lakes), was introduced. The results of this work were included in the HEDD report "Hydro Alternative Review Program" dated October 1976.

SECTION 2.0 - PROJECT AREA

2.1 AREA DESCRIPTION AND LOCATION

The development area, shown on Plate 2-1, is located approximately 170 air miles northwest of Vancouver at the head of Bute Inlet.

The Homathko River rises on the western edge of the Chilcotin Plateau and flows south to Tatlayoko Lake. The river then follows a general southwesterly course through extremely rugged Coast Range Mountains to its mouth on Bute Inlet. The Homathko drainage basin is considerably varied in its physical features from the semi-arid region near Tatlayoko Lake to the wet, heavily timbered coastal valley of the lower Homathko River.

For the most part the development area is extremely rough and rocky, besides being generally isolated and undeveloped. The area is generally uninhabited, although logging has been carried out in the lower Homathko valley below the power sites, and some settlers are established near the north end of Tatlayoko Lake.

The Homathko River in its course from Tatlayoko Lake through the Coast Range to the head of Bute Inlet drops about 2700 feet in 80 miles. The steepest section of the river extends upstream from Waddington Canyon, a narrow rock gorge with almost vertical walls, situated about 30 miles upstream from the mouth of the river. Waddington Canyon is only a mile long but its steep walls and fast-flowing water appear to have blocked the passage of salmon. It has also discouraged the use of the Homathko valley as an access route from the coast to the interior of British Columbia.

2.1 AREA DESCRIPTION AND LOCATION - (Cont'd)

Mosley Creek is the principal tributary of the Homathko River. From its source in Bluff Lake, Mosley Creek flows southward in a flat-bottomed valley about 1/2-mile wide, with steep-walled sides rising 4000 to 6000 feet to the mountain tops. The valley appears to be well suited for a reservoir site because it also provides a favourable location for a damsite near its lower end where the valley narrows. At this point, Mosley Creek becomes a swift-flowing, turbulent river in a rocky canyon which extends for the next 8 miles of its course to the Forks where it joins the Homathko River. At the Forks, Tiedemann Creek, flowing from the Tiedemann Glacier, also joins the main river. The Homathko valley is wider at the Forks, but soon converges as it approaches Waddington Canyon, where the canyon walls steepen to a maximum.

Below Waddington Canyon, the river gradient lessens and the valley widens again. For 30 miles to the head of Bute Inlet the river meanders from one side to the other and during its course is joined by three large tributaries draining the area on both sides of the river. The side valleys have flat bottoms and steep sides and, like most tributaries of the Homathko, drain from glaciers on the west and from the Homathko ice field on the east.

Tatlayoko Lake, at El. 2714 feet, lies in a trench 17 miles long on the edge of the Chilcotin Plateau, parallel to and approximately 10 miles west of Chilko Lake. It location is important to any proposal to divert water from Chilko Lake or Taseko Lake, and it serves as a natural reservoir for the upper Homathko watershed.

Chilko Lake, at El. 3846, and Taseko Lake, at El. 4348, also lie within extensive trenches which are 40 and 28 miles long, respectively. Both lakes drain northwards as part of the Fraser River system. Chilko Lake is an important salmon rearing and spawning area and, while much less important, Taseko Lake also supports a substantial

2.1 AREA DESCRIPTION AND LOCATION - (Cont'd)

salmon fishery. For perspective, the Chilko River supports 30 percent of the Fraser River sockeye salmon, second only to the Adams River salmon fishery.

2.2 ACCESS

The Homathko River area is considered to be a remote and isolated part of British Columbia. The eastern approach to the area is by the Chilcotin Highway, a gravelled road extending 150 miles from Williams Lake west to Tatla and Tatlayoko lakes. A rough road runs from Tatla Lake to Twist Lake in the upper Mosley valley. The western approach is by sea to the head of Bute Inlet and by logging road through the lower section of the Homathko River to Waddington Canyon. Float planes and helicopters provide a third means of access.

2.3 REGIONAL GEOLOGY

The region containing the Homathko River and its tributaries is, for the most part, underlain by the Tiedemann batholith of the Coast Plutonic Complex (refer to Plate 3-1). The batholith is an oblong body of rock consisting mainly of granodiorites, with its major axis extending from northwest to southeast. Formations of various thickness of diorites, quartz diorites, and highly metamorphosed (amphibolite grade) rock such as gneiss, mica and chlorite schists surround it. The metamorphosed rock formations cover the bottom of Nude Creek valley and form Mount Success and part of Mount Reliance. A secondary element, the Shelter Canyon stock, consisting mainly of granodiorite and undifferentiated pale granite, adjoins the Tiedemann batholith on the east.

The headwaters of the Homathko watershed including Bluff and Tatlayoko lakes, the northern two-thirds of Chilko Lake and the central

part of Taseko Lake lie in the Tyaughton (Intermontane) Belt. The mixed volcanogenic and clastic sedimentary rocks of the Tyaughton Belt are interspersed with volcanic rocks and folded in gentle synclines trending northeasterly.

The extreme northeastern corner of the project area, north of Tatlayoko and Chilko lakes and including the northern portion of Taseko Lake, is underlain by the Interior Plateau Volcanics. These rocks are largely Jurassic andesites but more recent sedimentary and volcanic rocks locally overlie these andesites.

The three geologic domains occurring in the Homathko watershed are separated by ancient regional faults. These regional faults and their associated local faults control the distribution of the geologic units as well as the orientation of the lakes and rivers.

The Yalakom Fault separates the Interior Plateau from the Intermontaine Belt can be traced from Ashcroft, where it joins the Fraser River Land Fault, north to near Miner Lake. The Yalakom Fault postdates the intrusion of the batholites to the west in at least a portion of its total travel, with approximately 200 km offset, estimated to have occurred from about 50 to 120 million years ago.

A large number of northeasterly trending thrust faults control the physiography of the Intermontane Belt. All of the major lakes and ridges in this belt lie parallel to these faults. The thrusting predates all other regional faulting in this area.

The Tchaikazan Fault, trending northwesterly across Chilko and Tatlayoko lakes, is the southwesterly boundary of the Intermontane Belt. This fault is easily traced and is well exposed along much of its length. It is the most recent of the regional faults affecting the study area. Its age of 25 million years, postdating the batholiths to the west, can be determined more readily than any of the others due to its good exposure.

2.3 REGIONAL GEOLOGY - (Cont'd)

Ottarasko and Stikelan Faults, located immediately to the southwest of the Tchaikazan Fault, are steeply dipping faults of Upper Cretaceous age (70 million years). These faults have been displaced by the Tchaikazan Fault, and are separated by faulting along the Homathko River below Tatlayoko Lake. They probably comprised a single feature prior to later faulting.

The Ottarasko Fault is subparallel to Ottarasko Creek and extends from the Homothko River near the outlet of Tatlayoko Lake northwesterly along Razorback Mountain to the headwaters of Mosely Creek, where it joins the Tehaikazan Fault.

The probable southeasterly extension of the Ottarasko Fault is the Stikelan Fault. This fault describes an arc from the Homathko River 5 km downstream of Tatlayoko Lake to the end of Franklin Arm of Chilko Lake before it finally turns north to join the Tchaikazan Fault east of Chilko Lake.

The local faulting which occurs at some of the damsites, described in Sections 7 to 11, is associated with the regional faults. Hence, none of the local faults should be more recent than about 25 million years and all of them are considered inactive.

SECTION 3.0 - ALTERNATIVE DEVELOPMENT SCHEMES

3.1 GENERAL

This section of the overview report describes the interrelationship of the four projects which comprise the basic non-diversion development, Scheme 1, and these four projects combined with the Taseko-Tatlayoko Diversion Project, which combination is designated as Scheme 2. For details and full descriptions of the individual component projects refer to Sections 7.0 to 11.0 inclusive, and for the principal project data refer to Table 3-1. The project drawings included in this report present the Taseko Diversion Scheme 2 solely.

Diversion of a portion of Chilko Lake flows has also been considered. However, in view of the importance of this lake and the river immediately downstream to the Fraser River salmon fishery, probably with severe diversion flow limitations imposed, no Chilko Lake diversion scheme is presented in this report. For further discussion of this flow diversion refer to Section 13.0.

3.2 DESCRIPTION OF THE DEVELOPMENT SCHEMES

The non-diversion Scheme 1 consists of an upstream storage project, two downstream power projects on the Homathko River, and a combined power and storage project on the tributary, Mosley Creek, as shown on Plates 3-1 and 3-2. Upstream flow regulation would be provided by 335,000 acre-feet of live storage on Tatlayoko Lake, afforded with development of the Tatlayoko Storage Project. The two mainstem Homathko projects, Nude Canyon and Waddington, would develop 1370 and 603 feet of head, respectively, and are assumed to be operated on a run-of-river basis. The Mosley Creek Project would develop 1490 feet of head and would provide flow regulation with 799,000 acre-feet of live storage to enhance power generation at this and the Waddington Project.

3.2 DESCRIPTION OF THE DEVELOPMENT SCHEMES - (Cont'd)

Scheme 2 consists of the same four projects, with increased installed generating capacity at the Nude Canyon and Waddington projects, and the Taseko-Tatlayoko Diversion Project. This latter project comprises diversion works to provide for the complete diversion of Taseko Lake flows and their conveyance to Tatlayoko Lake by canal and tunnel over a total distance of about 37 miles. In addition to the full diversion of the long-term average flow of 1543 cfs from Taseko Lake, the drainage area tributary to the diversion route would provide an additional average flow estimated to be 100 cfs. This combined flow would be passed through a 10-mile long power tunnel which would serve an additional powerhouse on the Tatlayoko Lake shoreline, providing for development of 1171 feet of head. With this diversion, natural flows would be increased by 350, 109 and 33 percent, on average, at the outlet of Tatlayoko Lake and at the Nude Canyon and Waddington projects, respectively.

With the 350 percent increase in average flows at the outlet of Tatlayoko Lake following diversion of Taseko Lake, a 6-mile long power tunnel and powerhouse, designated as the Bowl Lake Project, may be economically justified to develop the 303 feet of head above the Nude Canyon reservoir.

The power developments considered herein for the Mosley Creek and Waddington projects are virtually the same as presented in the 1972 B.C. Energy Board Report. However, for the Nude Canyon Project the head now proposed for development would be 1370 feet instead of the 890 feet previously considered. Furthermore, the Bowl Lake Project is newly introduced to complete the development of the Homathko River, 2276 feet, between Waddington Canyon and Tatlayoko Lake.

3.3 POWER POTENTIAL

A capacity factor of approximately 60 percent was selected for all projects except the Taseko-Tatlayoko Diversion Project, for

3.3 POWER POTENTIAL - (Cont'd)

which a capacity factor of approximately 75 percent was adopted. This higher capacity factor was selected for the diversion project to reduce the cost of the extensive diversion works. Based on the power studies, described in Section 5.0, and the foregoing capacity factors, the installed capacities and energy production for the two schemes of development are as summarized in the following tabulation:

Project	Installed Capacity (MW)	Average Energy (Av. MW)	Capacity Factor (%)
Scheme 1 (Non-diversion)			
Tatlayoko Storage	-	-	-
Nude Canyon	240	144	60
Mosley Creek	300	181	60
Waddington	360	219	60
TOTAL Scheme 1	900	544	60
Scheme 2 (Taseko Diversion)			
Tatlayoko Storage	-	-	-
Nude Canyon	500	300	60
Mosley Creek	300	181	60
Waddington	495	296	60
Taseko-Tatlayoko Diversion	175	132	75
TOTAL Scheme 2	1470	909	62
Bowl Lake (Optional Power Facilities)	75	44	59
TOTAL Scheme 2 with Bowl Lake Project	1545	953	62

3.4 COMPARATIVE DEVELOPMENT COSTS

Total capital costs, capacity costs and energy costs for the two schemes of development are summarized as follows:

3.4 COMPARATIVE DEVELOPMENT COSTS - (Cont'd)

Project	Capital Cost* ($ x 10^6)	Capacity Cost ($/kW)	Energy Cost ($/Av. kW)
Scheme 1 (Non-diversion)			
Tatlayoko Storage	27.1	-	-
Nude Canyon	394.5	1644	2740
Mosley Creek	421.5	1405	2329
Waddington	378.0	1050	1726
TOTAL Scheme 1	1221.1	1357	2245
Scheme 2 (Taseko Diversion)			
Tatlayoko Storage	27.1	-	-
Nude Canyon	461.3	923	1538
Mosley Creek	421.5	1405	2329
Waddington	415.4	839	1403
Taseko-Tatlayoko Diversion	398.8	2279	3021
TOTAL Scheme 2	1724.1	1173	1897
Bowl Lake (Optional Power Facilities)	135.6	1808	3082
TOTAL Scheme 2 with the Bowl Lake Project	1859.7	1204	1951

3.5 SEQUENCE OF DEVELOPMENT

For the non-diversion Scheme 1, the Waddington Project would probably be developed and made operational in conjunction with or following development of the Mosley Creek Project, recognizing the early need for flow regulation which would be provided by the latter

* October 1980 price levels.

3.5 SEQUENCE OF DEVELOPMENT - (Cont'd)

project. The Tatlayoko Storage Project would be completed in conjunction with the Waddington Project to provide early upstream flow regulation. Due to its comparatively high power cost and absence of storage, the Nude Canyon Project would probably be the last element in Scheme 1 to be developed.

For Scheme 2, the Nude Canyon Project would probably be developed and made operational in conjunction with or closely following development of the Taseko-Tatlayoko Diversion Project and its power facilities. The Tatlayoko Storage Project would be completed in conjunction with the Nude Canyon Project. Next in sequence, the Waddington Project would probably be made operational in conjunction with or closely following development of the Mosley Creek Project. Finally, the Bowl Lake Project would be developed when it is considered to be an economically acceptable element of Scheme 2.

SECTION 4.0 - HYDROLOGY

The Homathko River rises in an area with a continental climate of low precipitation and spring snowmelt flood peaks, then flows generally south over a distance of 60 miles into a progressively wetter area as it breaches the Coast Mountains. It flows into tidewater at the head of Bute Inlet, where fall rainfall floods are common.

The drainage area of the Homathko River is 2140 square miles. East of the Coast Mountains, on the Interior Plateau, annual precipitation is about 20 inches contrasted to the glacier covered peaks of the Coast Mountain which receive over 150 inches of precipitation a year.

Unit runoffs give a good indication of precipitation distribution over the Homathko basin. At the outlet of Tatlayoko Lake, unit runoff is estimated at 0.7 cfs/mi^2. As the river flows through wetter regions, the unit runoff increases to 2.1 cfs/mi^2 at the Nude Canyon Site and 3.2 cfs/mi^2 at the Waddington Site. The unit runoff from the basin downstream of the Waddington Site is estimated to be 10 cfs/mi^2.

The principal tributary of the Homathko is Mosley Creek. Although this creek also rises on the Interior Plateau, it flows through a somewhat wetter area. The unit runoff at the Mosley Creek Site is 3.0 cfs/mi^2.

Immediately to the east of Tatlayoko Lake and the eastern verge of the Homathko basin lie Chilko and Taseko lakes. All three lakes lie in trenches that extend from the Interior Plateau well back into the Coast Mountains; however, the Chilko and Taseko lakes drain in the opposite direction from Tatlayoko Lake into the Fraser River drainage system. Annual precipitation over the Taseko Lake basin

varies from about 100 inches in the mountains to about 20 inches at the outlet, resulting in a runoff of about 2 cfs/mi^2.

The hydrologic analysis used for this study was carried out in 1972 for the B.C. Energy Board Provincial Study. This analysis provided an estimation of historical monthly flows for a period of approximately 40 years and an estimation of floods for design of both the spillway and facilities for diverting the river during construction.

The 40 years of monthly flow records for each site, as used in the power studies, were developed by means of simple correlations with gauging stations in the same hydrologic zone. Average monthly streamflows at each site for the 40-year period are summarized in Table 4-1.

The method used for estimating diversion design floods was based on regional flood frequency analyses. The analyses have been based on recorded floods at stations with 10 years or more of records in the same homogeneous region as the site.

The Probable Maximum Flood (PMF) estimates for each site are based on an empirical relationship between the peak (or volume) of the PMF and the mean and coefficient of variation of the series of seasonal flood peaks (or volumes). Although most PMFs resulted from spring snowmelt, the PMFs for some coastal basins were due to fall rainfall used in derivation of average monthly streamflows and flood flows. A detailed description of the methodology is contained in Volume 5, Appendix III of the B.C. Energy Board Report. A summary of design floods are contained in Table 4-2.

The methods used in the B.C. Energy Board Report for estimating power flows and design floods are suitable for this report. However, the Homathko drainage basin has poor flow records and the hydrologic regime is complicated by glaciers and steep climatological

gradients. If studies are to be advanced to the feasibility level, a comprehensive network of climatological and streamflow stations would be required in order to estimate power flows and design floods with confidence.

SECTION 5.0 - POWER STUDIES

5.1 GENERAL

Power studies were made to determine the long-term average energy production from each of the three power projects with non-diversion Scheme 1; and from these three projects with increased installed capacity, from the Taseko-Tatlayoko Diversion Project and from the Bowl Lake Project with Taseko Lake Diversion Scheme 2. In addition, some preliminary project optimization studies were made to assess the effects on energy production of varying reservoir levels and drawdown depths.

5.2 METHODOLOGY AND ASSUMPTIONS

The power studies were undertaken using the computer program SHRUMO "Simulation of Hydro Resources under Monthly Operation" and the 40-year sequence of historical and correlated streamflow data for the period July 1928 to June 1968.

The B.C. Hydro integrated system, including planned future additions, was used initially as the base system for the SHRUMO program to which the Homathko River projects were added separately. On this basis, energy production from the Homathko River projects is the difference in power output from the integrated system with and without these projects. However, with simplified operation of this computer program the energy derived herein from these projects is effectively the same as that if operation independent of the base system is assumed.

5.2 METHODOLOGY AND ASSUMPTIONS - (Cont'd)

For purposes of these studies an approximate 60 percent capacity factor was adopted for all projects except the Taseko-Tatlayoko Diversion Project, for which a capacity factor of about 75 percent was adopted.

5.3 STUDY RESULTS

With 33 feet of drawdown on Tatlayoko Lake, sufficient live storage would be provided to completely regulate natural inflows to Tatlayoko Lake, including flows diverted from Ottarasco Creek into Tatlayoko Lake near the outlet.

Preliminary reservoir level optimization studies were carried out for the Nude Canyon Project considering a range of maximum normal reservoir levels varying from El. 1960 to El. 2500. Incremental energy and capacity benefits considered in conjunction with incremental project costs indicated the optimum maximum normal reservoir level to be at approximately El. 2440, as adopted for these overview studies. Five feet of drawdown has been provided for regulation of local inflows downstream of the Tatlayoko Storage Project.

For the Mosley Creek Project, an analysis of the effects on energy production was made for a range of drawdown depths varying from 235 feet, as selected for the B.C. Energy Board studies, to a minimum of 90 feet. It was determined that energy output was maximized approximately with a drawdown of 100 feet, which was adopted for these overview studies.

The Waddington Project forebay floods back to the combined Nude Canyon and Mosley Creek powerhouse. To allow for some regulation of local inflows downstream of the Nude Canyon and Mosley Creek dams a nominal 5 feet of drawdown has been included in these studies.

5.3 STUDY RESULTS - (Cont'd)

With the Taseko Diversion Scheme 2, drawdown of 45 feet would be provided on Taseko Lake to ensure complete regulation of diversion flows.

For the principal results and basic project data used in or derived from these power studies refer to Table 5-1.

SECTION 6.0 - BASIC CRITERIA AND ASSUMPTIONS

6.1 BASIC CRITERIA

1. An electrical power factor of 0.95 was adopted.

2. Maximum continuous generator capacities are matched to the turbine full gate output (with rated turbine discharge) at maximum net head (with maximum normal reservoir level).

3. With rated turbine discharge, a turbine efficiency of 91 percent and a generator efficiency of 98.5 percent are assumed.

4. Long-term average energy output is determined using an average combined turbine, generator and transformer efficiency of 91 percent, together with weighted average hydraulic energy losses based on 120 percent of average power flow combined with actual month by month gross heads over the study period.

5. Freeboard allowances above maximum normal reservoir level are 25 feet for earth or rockfill structures and 15 feet for concrete structures.

6. Spillways are designed to accommodate the spillway design floods listed in Table 4.2 with a flood surcharge of 10 feet above maximum normal reservoir level.

7. Diversion works are designed to accommodate floods with a 30-year return frequency, as listed in Table 4.2.

8. Reservoir clearing is assumed to provide a 25-foot zone below minimum reservoir level which is absolutely clear of trees and treetops. It is further assumed that trees will average 35 feet

6.1 BASIC CRITERIA - (Cont'd)

in height. Accordingly, clearing is assumed to be required over that area lying between 60 feet below minimum reservoir level and 3 feet above maximum normal reservoir level.

9. Earthfill dams are assumed to be of zoned construction with upstream and downstream slopes at 2.5 and 2.0 horizontal to 1.0 vertical respectively. This common basis is adopted in view of the very limited knowledge at this time of construction material availability and quality.

10. For all construction schedules, it is assumed that project approval would have been received 6 months before award of the first contract.

6.2 GENERAL BASIS FOR COST ESTIMATES

A summary of the detailed cost estimate for each project is presented at the end of each project description section of this report. All costs are based on October 1980 price levels. The cost estimates have been prepared on the basis of detailed quantity and equipment take-offs for the various project arrangements as shown on the report drawings and as supplemented by additional design information. The total direct costs provide for all project development costs including all site high voltage switching stations and their enclosures, up to the outgoing transmission line bushings and reactors. Site switching station costs have been adjusted so that costs incurred as the result of incoming transmission lines from other projects within a scheme of development are borne by the other interconnected projects. Transformation and SF6 switchgear at 500 kV has been adopted for estimation purposes. However, a lower voltage level, such as 230 kV, may be found appropriate for local transmission, with a 500 kV collector switching station provided for distant transmission.

6.2 GENERAL BASIS FOR COST ESTIMATES - (Cont'd)

Contingencies have been applied at 20 percent to all direct construction costs, including costs of land and land rights, water rights, flowage and area access, except that contingencies of only 7 1/2 percent have been applied to all electrical and mechanical equipment costs.

Costs of engineering, investigations and supervision have been included at 9.0 percent of total direct costs including contingencies.

The costs of construction insurance and bonds are included on the basis of 1.3 percent of total direct costs including contingencies.

Corporate overheads and the cost of interest during construction are not included in the estimates. However, to permit estimations of such interest costs, a cash flow is provided at the end of the project description sections for only those projects considered to merit further investigation during feasibility studies.

Costs provided under the headings of Land and Rights and Flowage provide for the direct or tangible costs of reservoir clearing, purchase or replacement of land and all facilities such as highway or settlements which are subject to flooding by hydroelectric development of a site. No attempt has been made to provide for environmental or socio-economic costs.

SECTION 7.0 - TATLAYOKO STORAGE PROJECT

7.1 DESCRIPTION OF SITE

The Tatlayoko Lake Storage Project would be located at the outlet of Tatlayoko Lake 62 miles upstream from the mouth of the Homathko River.

The project would raise the lake water from its normal water level of El. 2714 to a maximum normal reservoir level of El. 2743. The reservoir surface area at maximum normal water level would be 11 250 acres, and the live storage would be 335 000 acre-feet with drawdown to El. 2710. Based on the 40-year period, 1928 to 1968, the long-term average flow from Tatlayoko Lake would be 472 cfs for Scheme 1 (non-diversion) and 2125 cfs for Scheme 2 (Taseko Diversion).

The proposed project occupies a broad valley infilled with alluvial deposits of gravel and sand. The left abutment is comprised of bedrock covered with talus at its base. The right abutment rises gently up to and across Ottarasko Creek. Beyond the creek this abutment rises more steeply with overburden material showing near the creek and rock outcrops and talus slopes occurring above.

7.2 GEOLOGICAL FEATURES

Subsurface investigations have not been made at this site.

The left abutment rock is of greenstone breccia and volcanic tuff conglomerate. The right abutment is composed of shales, mudstones and arkoses. An inferred fault contact between the sedimentary and volcanic rocks probably underlies the upper right abutment of the damsite. The 1/2-mile wide valley is composed of interstratified sand and gravel which is estimated to extend approximately 100 feet over bedrock.

7.3 ARRANGEMENT OF STRUCTURES

The proposed project arrangement is shown on Plate 7-1. It comprises a main earthfill dam, a small saddle dam barring Ottarasko Creek, a spillway within the left abutment, and a canal diverting Ottasarko Creek into the reservoir.

The earth dam would be about 2800 feet long, including the right bank cutoff, and about 85 feet in height; the saddle dam would be 500 feet long and about 30 feet in height. Both dams would be built of homogenous fill. A slurry trench cutoff would be constructed under the main dam to bedrock level for seepage control.

Releases would be made by a spillway with two radial gates, each 12 1/2 feet wide and 37 feet high. A 210-foot long stilling basin would be required for energy dissipation. The spillway would be capable of discharging a design flood of 15 000 cfs with the reservoir surcharged 5 feet to El. 2748.

The Ottarasko Creek diversion canal, of trapezoidal section, would be about 1800 feet long.

River diversion for construction of the slurry trench cutoff underneath the Homathko River would be accomplished with a channel excavated west of the river, designed for a maximum flow of 1000 cfs. River diversion during construction of the main dam would be through the spillway, with a design diversion flow of 5500 cfs.

Access to the site would require construction of a 5 1/2-mile long road extension from the existing road located on the east side of the lake.

7.4 CONSTRUCTION CONSIDERATIONS

The time required for final design and construction is estimated to be 2 1/2 years after award of first contract.

Pervious fill and concrete aggregate would probably be available from the Ottarasko Creek fan deposit on the site. If required, aggregate for high grade concrete could probably be manufactured from granitic rock located on the south shore of the lake near its outlet. Impervious fill occurs at a point on the east side of the lake about 2 miles north of the site.

7.5 ESTIMATE OF COST AND CASH FLOW

Estimated capital costs, in terms of October 1980 prices, are summarized in Table 7-1. As shown, the total cost of this project is estimated to be $27.1 million.

Estimated annual cash flow related to the construction schedule is summarized in Table 7-2.

SECTION 8.0 - NUDE CANYON PROJECT

8.1 DESCRIPTION OF DAM AND POWERHOUSE SITES

The Nude Canyon dam arrangement comprises a dam, spillway and power intake. It is located 1.3 miles downstream from the confluence of Nude Creek with the Homathko River between Success Mountain on the right bank and Reliance Mountain on the left bank, approximately 45 miles upstream of the river mouth. The canyon, a V-shaped gorge, is suited for a fill dam or possibly a concrete arch dam. The abutments rise at about 35° to 45° inclination. The left abutment is treed sparsely; near and above the proposed dam crest it is irregular in shape and badly weathered. The right abutment is smooth and appears flawless. Overburden consists of minor talus deposits on the lower slopes and a narrow gravel bar in the riverbed. On the right bank, the dam axis is located approximately 750 feet downstream of Bellamy Creek ravine, through which a glacier drains and frequent snow avalanches occur.

The power tunnel, located within the right abutment, surfaces 4 1/2 miles downstream on a ridge beside Lowwa Lake. From the tunnel portal, the fairly regular treed hillside slopes down to the powerhouse site at a gradient of 2.0 to 2.5 horizontal to 1.0 vertical.

The powerhouse site is located on Mosely Creek approximately 0.8 miles upstream of the confluence with the Homathko River. Overburden depth is expected to be shallow at this site.

8.2 GEOLOGICAL FEATURES

No subsurface investigations have been conducted at this site.

8.2 GEOLOGICAL FEATURES - (Cont'd)

Bedrock at the damsite consists of predominantly competent greenish gneiss and sills of quartz-hornblende diorite. On the right abutment phyllite has also been noted in minor quantity. Foliation in the gneiss strikes across the river and dips 40° to 45° downstream. Joints in the gneiss and diorite sills are spaced at intervals of a foot to a few feet. While there are no definite faults mapped on site, a fault is suspected high on the right abutment. A fault, possibly a major one, exists on the left abutment striking at a right angle to the river several hundred yards downstream of the proposed dam axis.

The power tunnel would be driven through gneiss and intrusive sills of quartz-hornblende diorite for almost 3 miles before entering diorite gneiss, quartz diorite and finally terminating in banded granodiorite. It is anticipated that 40 percent of the tunnel would have to be shotcrete lined.

The penstocks and the powerhouse, located in the Mosely Creek valley, would be founded on hard and sound granodiorite.

8.3 HEAD, FLOW AND POWER

With a maximum normal reservoir level of El. 2440 the reservoir has a surface area of 2460* acres. The reservior is confined to the narrow canyon, up the Homathko River, with a short narrow reach up Nude Creek and provides pondage if approximately 12 270* acre-feet would be obtained with a drawdown of 5 feet. With a normal tailwater level of El. 1070 at the powerhouse the maximum gross head would be 1371 feet.

8.3 HEAD, FLOW AND POWER - (Cont'd)

Based on the 40-year period, 1928 to 1968, the long-term average power flow for Scheme 1 (non-diversion) would be 1477 cfs and for Scheme 2 (Taseko Diversion) 3148 cfs. This corresponds to approximately 99 percent flow utilization for either scheme.

With an installed capacity of 240 MW for Scheme 1, average annual energy production at a capacity factor of 60 percent would be 1260 million kW.h or 144 average MW. With an installed capacity of 500 MW for Scheme 2, average annual energy production at a 60 percent capacity factor would be 2630 million kW.h or 300 average MW.

8.4 ARRANGEMENT OF STRUCTURES

The proposed project arrangement for development Scheme 2 is shown on Plates 8-1, 8-2 and 8-3. It comprises a 680-foot high earthfill dam, a chute spillway and a power intake on the right dam abutment; a 4 1/2 mile long power tunnel; and 3400-foot long surface penstocks leading to the powerhouse located on Mosley Creek.

The free-flow chute spillway of three bays, each 50 feet wide, is capable of discharging the design flood of 40 000 cfs with the reservoir surcharged 10 feet to El. 2450. The discharge chute would have an overall length of 1400 feet.

River flows with a design diversion capacity of 10 000 cfs would be diverted around the damsite during construction via a 3250-foot long, 24-foot diameter tunnel located in the left abutment. It is assumed the tunnel would require shotcrete lining over 40 percent of its length. The diversion tunnel would be closed by a steel bulkhead gate in the upstream portal structure to permit construction of the permanent tunnel plug as the reservoir is filled.

8.4 ARRANGEMENT OF STRUCTURES - (Cont'd)

The power intake comprises a horizontal tunnel at invert El. 2387 and a concrete lined shaft housing a fixed wheel gate 15 feet wide x 20 feet high and a bulkhead gate of the same dimensions. The gates would normally be lowered only for inspection or repair of the power tunnel.

The power tunnel, 4 1/2 miles long, would be of modified horseshoe shape excavated to a nominal diameter of 24 feet. It is assumed that 40 percent of its length would require shotcrete lining. A rock trap would be provided just upstream of a surge shaft.

The concrete lined surge shaft, located 300 feet upstream of the tunnel portal would be 60 feet in diameter and about 200 feet in height. The conduit would be bifurcated at the tunnel portal immediately upstream of a valve house, equipped with two 11-foot diameter butterfly valves providing for emergency closure and unit servicing.

The two 3400-foot long steel penstocks, 11.0 feet in diameter, would be founded on the relatively uniform and nominal gradient slope occurring above the powerhouse site.

The surface powerhouse, would house the power facilities of both the Nude Canyon portion and the Mosely Creek projects. The Nude Canyon portion would contain two generating units each comprising a 300 rpm Francis turbine rated at 340 000 hp under a net head of 1242 feet, and a generator capable of a maximum continuous output of 250 MW.

The SF-6 switchgear building would be located above the transformers at the rear of the powerhouse. In addition to the generating units, switchgear bays are required for both of the 500 kV transmission circuits feeding east to the Tatlayoko Lake powerhouse and west to the Waddington powerhouse.

8.4 ARRANGEMENT OF STRUCTURES - (Cont'd)

Access to this powerhouse from the Waddington property would require construction of 5 miles of high level road west of the Homathko River and a tunnel 2 miles long. Access to the damsite from the powerhouse would require construction of 1 3/4 miles of road and a tunnel 3 miles long.

8.5 CONSTRUCTION CONSIDERATIONS

As shown on Plate 8-1 the time required for final design and construction is estimated to be 6 3/4 years after award of the first contract.

Pervious damfill is available, probably in sufficient quantities, from the river valley 2 miles upstream of the damsite. Additional pervious material would be available from the moraines on the Reliance Mountain slopes. Clay deposits, which could be used as impervious core for the fill dam, occur 3 1/2 miles upstream of the damsite in the Nude Creek valley.

Concrete aggregate for the spillway, power intake, diversion tunnel and power tunnel appears to be available, probably in sufficient quantities, about 1/2 mile upstream of the dam axis.

Concrete aggregate for the powerhouse, penstock, valve house and the surge chamber would probably be available from the alluvial deposit at Tiedemann Creek in front of the powerhouse site.

8.6 ESTIMATE OF COST AND CASH FLOW

Estimated capital costs for the non-diversion Scheme 1, in terms of October 1980 prices, are summarized in Table 8-1. As shown, the total capital cost for the 240 MW power development is estimated to be $394.5 million or $1644 per installed kilowatt.

8.6 ESTIMATE OF COST AND CASH FLOW - (Cont'd)

Similarly, estimated capital costs for the 500 MW power development with the Taseko Diversion Scheme 2, is estimated to be $461.3 million or $923 per installed kilowatt, as shown in Table 8-2.

Estimated annual cash flow related to the construction schedule, for Scheme 2 only, is summarized in Table 8-3.

SECTION 9.0 - MOSLEY CREEK PROJECT

9.1 DESCRIPTION OF DAM AND POWERHOUSE SITES

The Mosley Creek damsite is located on Mosley Creek about 8 miles upstream of its confluence with the Homathko River at the foot of the western slopes of Mount Success, and approximately 48 miles upstream of Bute Inlet. The site is in a narrow reach at the downstream end of the broad and flat gradient upper Mosley Creek valley, a hanging valley infilled with glacial or lacustrine debris. The right abutment rises steeply for about 1500 feet above the creek and displays sound bedrock over most of its height. The lower slopes are generally covered with talus. Tree growth is sparse. The lower left side of the valley is flatter, about 20° to 25° in inclination, and is covered with slide debris and fan material to about 300 feet above the creek level where it tapers out against the steeper rock flanks of Mount Success. The damsite area is covered mainly with deciduous brush.

The powerhouse site is located on Mosely Creek approximately 7 miles downstream of the damsite and about 0.8 miles upstream of the creek's confluence with the Homathko River. The slope behind the powerhouse site rises on a relatively regular gradient, approximately 2.5 horizontal to 1.0 vertical, to the tunnel portal area west of Lowwa Lake. This slope and the powerhouse site are extensively forest covered. Overburden cover is expected to be shallow over bedrock.

9.2 GEOLOGICAL FEATURES

Subsurface investigations carried out in 1957 and 1958 by the B.C. Power Commission included 11 diamond drill holes and an electrical resistivity survey.

9.2 GEOLOGICAL FEATURES - (Cont'd)

Bedrock at the damsite consists of gneissic quartz diorite with foliation dipping at about 45° southwest. Drill cores taken in the year 1958 display rare iron stained zones, which can be interpreted as inclined fractures along which oxygenated surface waters can penetrate. No clear orientation of these fractures could be established from present exposures. The aranodiorite contains numerous dacite dykes. The dyke rock and the surrounding host rock are heavily fractured, as observed in the drill core. A resistivity survey indicated that river alluvium may be up to 120 feet deep.

The power tunnel would be in granitic rocks except for a stretch approximately 1 1/2 to 2 1/2 miles downstream of the damsite, where it would pass through highly metamorphosed sediments. It is anticipated that 25 percent of the tunnel would require concrete lining.

The penstock and the powerhouse would be located on hard and sound granodiorite.

9.3 HEAD, FLOW AND POWER

The reservoir would have a surface area of 9000 acres, and live storage of 799 000 acre-feet with 100 feet of drawdown. With maximum normal reservoir level El. 2560 and normal tailwater level El. 1069, the maximum gross head would be 1491 feet.

Based on the 40-year period, 1928 to 1968, the long-term average power flow would be 1770 cfs. This corresponds to approximately 99 percent flow utilization.

With an installed capacity of 300 MW average annual energy production would be 1590 million kW.h or 181 average MW with a 60 percent capacity factor.

9.4 ARRANGEMENT OF STRUCTURES

The proposed project arrangement is shown on Plates 9-1 and 9-2. It comprises a 450-foot high concrete gravity dam with a spillway and power intake built integrally into the structure; a 6 3/4-mile long power tunnel; and 3300-foot long penstocks leading to the powerhouse located on Mosely Creek.

The ungated surface spillway, with three 50-foot wide bays, would be located over the central portion of the dam, and is capable of discharging the design flood of 55 000 cfs with the reservoir surcharged 20 feet to El. 2580. The discharge chute would be located on the downstream slope of the dam, terminating in a flip bucket.

River diversion would be accomplished by constructing a 22-foot diameter, 600-foot long fully concrete-lined diversion tunnel in the left abutment; and upstream and downstream cofferdams built on pervious alluvium, requiring slurry trench cutoffs to control seepage. The tunnel would be designed for a design diversion flow of 12 000 cfs. The tunnel would be closed by a steel bulkhead gate in the upstream portal structure to permit construction of the permanent tunnel plug as the reservoir is filled.

The power intake is located in the left wing of the dam. It consists of a horizontal tunnel at invert El. 2420 and shafts which are equipped with a fixed wheelgate 12 feet wide x 18 feet high and a bulkhead gate of identical dimensions. The gates would normally be lowered only for inspection or repair of the power tunnel.

The power tunnel, 6 3/4 miles long, would be of the modified horseshoe shape excavated to a nominal diameter of 19 feet. It is assumed that 25 percent of its length would require a 15-inch concrete lining. A rock trap would be provided just upstream of a surge shaft.

9.4 ARRANGEMENT OF STRUCTURES - (Cont'd)

The concrete lined surge shaft, located 500 feet upstream of the tunnel portal would be 60 feet in diameter and about 500 feet in height. The power conduit would be bifurcated at the tunnel portal immediately upstream of a valve house. The valve house would be equipped with two 9-foot diameter butterfly valves which would provide for emergency closure and unit servicing.

The two 3260-feet long steel penstocks, 9 feet in diameter, would be founded on the relatively regular and nominal gradient slope occurring above the powerhouse site.

The surface powerhouse would house the generating equipment of both the Mosely Creek and Nude Canyon projects. Service and control bay facilities would be common to both projects. The Mosley Creek portion of this powerhouse would contain two generating units, each having a 360 rpm Francis turbine rated at 204 000 hp under a net head of 1329 feet, and a generator capable of a maximum continuous output of 150 MW.

The SF-6 switchgear building would be located above the six single-phase 13.8/500 kV transformers at the rear of the powerhouse. In addition to the generating units, switchgear bays are required for both of the 500 kV transmission circuits feeding east to the Tatlayoko Lake powerhouse and west to the Waddington Project.

Access to this powerhouse from the Waddington project would require construction of 5 miles of high level road west of the Homathko River and a tunnel 2 miles long. Access to Mosley Creek damsite would require construction of 9 miles of road from the powerhouse site and 28 miles of road from Middle Lake along and above the western banks of Mosley Creek reservoir.

9.5 CONSTRUCTION CONSIDERATIONS

As shown on Plate 9-2 the time required for final design and construction is estimated to be 5 3/4 years after award of the first contract.

Construction aggregates for the concrete gravity dam are believed to be available in sufficient quantities within reasonably close distance of the dam. One potential source would be the alluvial fan a short distance downstream of the damsite.

The alluvial deposit at Tiedemann Creek in front of the powerhouse is a potential aggregate source for construction of the facilities at and in the vicinity of the powerhouse.

9.6 ESTIMATE OF COST AND CASH FLOW

Estimated capital costs, in terms of October 1980 prices, are summarized in Table 9-1. As shown, the total capital cost for the 300 MW power development is estimated to be $421.5 million or $1405 per installed kilowatt.

Estimated annual cash flow related to the construction schedule is summarized in Table 9-2.

SECTION 10.0 - WADDINGTON PROJECT

10.1 DESCRIPTION OF SITE

The Waddington Project is located 1/2 mile upstream of the confluence of Klattesine Creek and the Homathko River, near the downstream end of Waddington Canyon, approximately 30 miles upstream of the river mouth.

The damsite is in a narrow canyon with precipitous bedrock walls rising from river level. The left abutment, irregular in shape, has an average inclination of about 60° from the horizontal at the proposed dam axis. The right abutment is smoother and flatter with an average inclination of about 45°. On the lower valley slopes there are accumulations of large boulders. The alluvium in the river channel is indicated to be of shallow depth.

10.2 GEOLOGICAL FEATURES

Subsurface investigations carried out in 1957 and 1958 by the B.C. Power Commission included a total of five diamond drill holes.

Bedrock at the damsite is sound biotite granodiorite with a few variations such as bands of diorite gneiss. The rock is hard and sound. A few dykes of green andesite rock, about 2 feet in width trend northerly. On the surface they appear friable, but they are probably sound at depth. There are two sets of faults which trend at an angle of about 45° to the river and may be up to 25 feet wide. They have been intruded by andesite dykes. Another less conspicuous set of conjugate faults was observed to subparallel the river. These conjugate faults trend east-west and are at an angle of about 80° to the other set of faults. This fault set dips vertically and varies up to approximately 10 feet in width.

No buried or interglacial channel occurs at this site.

10.3 HEAD, FLOW AND POWER

At the maximum normal reservoir level of El. 1070 the reservoir would have a surface area of 1900 acres, and the pondage would be approximately 9000 acre-feet with a drawdown of 5 feet.

Based on the 40-year period, 1928 to 1968, the long-term average power flow for Scheme 1 (non-diversion) would be 4860 cfs and for Scheme 2 (Taseko Diversion) 6556 cfs. This corresponds to a flow utilization of approximately 97 and 99 percent for the two respective development schemes.

With an installed capacity of 360 MW for Scheme 1 (non-diversion) average annual energy production at a capacity factor of 60 percent would be 1920 million kW.h or 219 average MW. With an installed capacity of 495 MW for Scheme 2 (Taseko Diversion) average annual energy production at a 60 percent capacity factor would be 2590 million kW.h or 296 average MW.

10.4 ARRANGEMENT OF STRUCTURES

The proposed project arrangement for development Scheme 2 is shown on Plates 10-1 and 10-2. It comprises a 655-foot high concrete arch dam with integral free-crest spillway and intermediate level outlets, and power facilities located within the left abutment.

The free-crest spillway, located directly above the river channel, would consist of nine ungated bays of 50 feet width, and would be capable of discharging 103 000 cfs with a flood surcharge of 15 feet.

The intermediate level outlets, consisting of 5 sluice outlets controlled by radial gates 8.2 feet wide x 10.5 feet high, would provide an additional 32 000 cfs of release capability. The combined discharge capability of the two release facilities would be

10.4 ARRANGEMENT OF STRUCTURES - (Cont'd)

135 000 cfs, equal to the Probable Maximum Flood. Access to the intermediate level outlets would be by mean of a ramp on the downstream side of the dam via the right bank tunnel portal at crest level.

Diversion of flows around the damsite would be accomplished by means of a 750-foot long fully concrete lined tunnel, 30 feet in diameter, located in the left abutment and associated cofferdams. This diversion tunnel would be designed for a flood flow of 40 000 cfs. It would be closed by a steel bulkhead gate in the upstream portal structure to permit construction of the permanent tunnel plug as the reservoir is filled.

The power intakes would comprise three separate penstock inlet structures located in the left abutment a short distance upstream of the dam crest. Each inlet structure would consist of a horizontal shaft at invert El. 1033 and a tower equipped with a fixed wheel gate 10.7 feet wide by 16 feet high and a stoplog enclosure.

The three penstocks, each approximately 850 feet long, would consist of a 14.7-foot diameter concrete lined section below the intake and a 13.2-foot diameter steel lined section extending over the last 200 feet upstream of the powerhouse.

The underground powerhouse would contain three generating units, each having a 240 rpm Francis turbine rated at 225 000 hp under a net head of 586 feet, and a generator capable of a maximum continuous output of 165 MW.

The single-phase 13.8/500 kV transformers would be located underground in a chamber immediately downstream of the powerhouse. EHV lead shafts about 400 feet long would connect with the SF-6 switchgear building located above at ground level. The switchgear would provide for, in addition to the three generating units, both a 500 kV transmission circuit towards Bute Inlet as well as to interconnect with the Nude Canyon switchgear building.

10.4 ARRANGEMENT OF STRUCTURES - (Cont'd)

Access to the dam would require construction of 5 miles of new road along the right bank of the river from the end of an existing logging road originating at Bute Inlet and 2 miles of tunnel terminating on the right bank at the crest of the dam. Interconnection with interior highways the Nude Canyon-Mosely Creek powerhouse would require construction of an additional 5 miles of road and 2 miles of tunnel. Access to the powerhouse would be by means of a tunnel approximately 1200 feet long and about 1 mile of road connecting to the main right bank road via a new bridge across the Homathko River.

10.5 CONSTRUCTION CONSIDERATIONS

As shown on Plate 10-1, the time required for final design and construction is estimated to be 6 3/4 years to first in service after award of the first contract.

The alluvial fan near the confluence of the Homathko River and Klattestine Creek would probably provide suitable concrete aggregate for the whole project. An alluvial fan on the right bank about 1/2 mile further downstream could be considered as an alternative source. Sand deposits for high quality concrete are not as readily available within close proximity of the dam. Large sand deposits in the river benches below the canyon may not be suitable because the sand is generally too fine-grained, is contaminated with organic material and contains a high percentage of mica.

10.6 ESTIMATE OF COST AND CASH FLOW

As shown in Table 10-1, the total capital cost of the 360 MW power development is estimated to be $378.0 million or $1036 per installed kilowatt.

Similarly, estimated capital costs for the 495 MW power development, with the Taseko Diversion Scheme 2, is estimated to be $415.4 million or $839 per installed kilowatt, as shown in Table 10-2.

Estimated annual cash flow related to the construction schedule, for Scheme 2 only, is summarized in Table 10-3.

SECTION 11.0 - TASEKO-TATLAYOKO DIVERSION PROJECT

11.1 GENERAL DESCRIPTION OF DIVERSION ROUTE

The proposed project arrangement is shown on Plate 11-1. It comprises diversion dam on Taseko Creek to utilize Taseko Lake as a storage reservoir; a 36-mile long diversion system of tunnels, conduits, canals and lakes to convey the Taseko Lake flows to Tatlayoko Lake; and power facilities located on the east shoreline of Tatlayoko Lake. The complex flow diversion system includes a 5.7-mile long diversion tunnel between Taseko Lake and Elkin Creek, canals and conduit between Elkin Pool and Konni Lake, canals and conduit between Konni and Nemaia lakes, the Nemaia flow control dam and 5-mile long reservoir flooding back to Nemaia Lake, canal between the Nemaia Dam and the power tunnel inlet, and a 10-mile long power tunnel from the east shoreline of Chilko Lake and under this lake to Tatlayoko Lake. The diversion route passes over four Indian reserves involving 6 miles of canal and flooding by a portion of the Nemaia reservoir.

11.2 DESCRIPTION OF SPECIFIC STRUCTURE SITE AREAS

(a) Diversion Dam

The main Taseko damsite is located on the Taseko River 4 1/2 miles downstream of lower Taseko Lake outlet and 55 road miles south-southwest of Hanceville. The axis of the dam crosses the river below its first sharp reverse curve, where bedrock is exposed on both abutments. The upper parts of the abutments are covered by overburden of unknown depth.

The site for a small, required saddle dam is located about 1300 feet east of the main dam in a relatively narrow and flat-bottomed divide, at a point approximately 0.2 miles northwest of a small unnamed lake.

11.2 DESCRIPTION OF SPECIFIC STRUCTURE SITE AREAS - (Cont'd)

(b) Flow Diversion System

From its intake on the west arm of the Taseko reservoir, approximately 900 feet upstream from the main Taseko dam, the water supply tunnel would be directed to the northwest under high ground comprising, for most of its length, a ridge which culminates in Cardiff Mountain. The tunnel would discharge into Elkin Creek at a point about 1 mile southwest of the Cardiff Mountain peak and approximately 1 1/2 miles upstream of the Konni Lake valley.

Elkin Creek, which flows north from the Konni Lake valley towards Vedan and Elkin lakes before flowing onwards to the Taseko River, would be diverted into Konni Lake by diversion works across the creek and a canal directed westward to Konni Lake. The 1 1/2 miles of valley west of the Elkin Pool diversion works consists largely of very flat, wet, marshy ground. About 1/2 mile of this route would be on the Tanakut Indian Reserve No. 4.

The diversion route between Konni and Nemaia lakes is similarly swampy terrain. Approximately 1/2 mile of this portion of the diversion route would be on Lohbiee Indian Reserve No. 3.

Nemaia Dam would be located across Nemaia Creek near the end of a narrow valley 3 1/2 miles southwest of Nemaia Lake and 0.3 miles west of a small Indian village which is sited on Indian Reserve No. 2A. While the dam is located just off this reserve, the related reservoir would flood the central 0.8 miles of Indian Reserve No. 2A and a corner of Indian Reserve No. 2.

Downstream of Nemaia Dam diversion canal would continue on the north side of Nemaia Creek across open and gentle slopes to the shore of Chilko Lake. From there the canal would follow the shore line approximately 70 to 80 feet above the lake through

11.2 DESCRIPTION OF SPECIFIC STRUCTURE SITE AREAS - (Cont'd)

sparsely treed terrain to a rocky promontory within which the power tunnel intake would be located. The first 4 miles of this canal route would be located on Indian Reserve No. 1A.

(c) Power Facilities

From its intake above the east shoreline of Chilko Lake, approximately 12 miles south of the lake outlet, the diversion flows would be conveyed by a deepshaft to below lake level where a power tunnel would be directed in a northwesterly direction under mountainous terrain to Tatlayoko Lake. The power tunnel portal would emerge on the relatively flat slopes present above this latter lake approximately 6 miles north of its outlet. The slopes below the tunnel portal vary from near horizontal over the upper portion of the penstock route to about 3.0 horizontal to 1.0 vertical over the lower portion above the powerhouse site. These slopes are indicated to have a shallow overburden cover over bedrock, and bedrock outcrops occur on the shoreline in the powerhouse site area. The powerhouse area, in particular, is densely forested.

11.3 GEOLOGICAL FEATURES

(a) Diversion Dams

The broad valley immediately downstream of Taseko Lake is underlain by unconsolidated glacial deposits which may exceed 300 feet in depth. For the most part, the Taseko damsite is underlain by black shales and argillaceous siltstones of Jurassic age, which strike perpendicular to the river and dip near vertically. Overburden depths are generally shallow except under the right abutment where possibly up to 200 feet of overburden may be present under the rightwing of the dam.

11.3 GEOLOGICAL FEATURES - (Cont'd)

(b) Flow Diversion System

The water supply tunnel between Taseko Lake and Elkin Creek would be located mainly in steeply dipping soft shales and siltstone, but may intersect some basalt which overlie the sediments in places.

The diversion route from Elkin Pool to Chilco Lake comprises alluvial deposits primarily of sandy gravels.

(c) Power Facilities

The power tunnel between Chilco and Tatlayoko lakes would intersect sandstone, grit and pebble conglomerates with interbedded black siltstone, and silty shales. Attitude of bedding is variable because of folding and a number of possible thrust faults in the Intermontaine Belt in which the power facilities are located.

11.4 HEAD, FLOW AND POWER

The diversion dams downstream of Taseko Lake would raise the lake water from its normal water level of El. 4350 to a maximum normal reservoir level of El. 4395. The surface area of the lake reservoir at maximum normal water level would be 15 000 acres, and the live storage would be 520 000 acre-feet with a drawdown of 45 feet.

With a maximum normal water level of El. 3914 at the power intake and an average tailwater level of El. 2733 at Tatlayoko Lake the average gross head would be 1181 feet.

With an installed capacity of 175 MW average annual energy production would be 1160 million kW.h or 132 average MW with a capacity factor of about 75 percent.

11.5 ARRANGEMENT OF STRUCTURES

(a) Diversion Dams

Plate 11-2 shows the general arrangement of Taseko Dam. It comprises a 215-foot high earthfill dam, a chute spillway on the left bank, a diversion tunnel within the right bank and a saddle dam beyond the east bank of the main dam with a maximum height above grade of about 40 feet. The water supply tunnel intake is located immediately upstream of the spillway approach channel.

The ungated ogee spillway, with three bays each 55 feet wide, is capable of discharging a design flood of 20 000 cfs with a reservoir surcharge to El. 4405. The length of the spillway chute would be approximately 470 feet.

The 300-foot long, 25-foot diameter, unlined diversion tunnel would be designed for a diversion flood of 8000 cfs.

(b) Flow Diversion System

The general arrangement of the water supply tunnel and the Elkin Pool diversion works are shown on Plate 11-3.

The tunnel intake consists of a horizontal tunnel at invert El. 4320 and a short concrete-lined shaft, which is equipped with a fixed wheel gate 13.5 feet wide x 15.5 feet high and a bulkhead gate of the same dimensions.

The tunnel, 5 3/4 miles long with a nominal 18-foot diameter D-shaped section, would have a discharge capacity of 2000 cfs. It is assumed that 50 percent of the tunnel length would require concrete lining to a diameter of 15 1/2 feet. A valve house would be provided at the tunnel outlet to house a 108-inch diameter Howell-Bunger valve to control releases into Elkin Creek.

11.5 ARRANGEMENT OF STRUCTURES - (Cont'd)

The Elkin Pool, diverting water from Elkin Creek into Konni Lake, would have a surface area of about 6 acres and a maximum depth of 35 feet with maximum normal water level El. 4040.5. An ungated spillway with a short stilling basin would be provided at the exit of Elkin Creek. The spillway is 160 feet wide and would have a discharge capacity of 2400 cfs surcharging 3 feet over the maximum normal water level.

Plates 11-4 and 11-5 show the arrangement of the diversion system between Elkin Pool and the power tunnel intake at Chilko Lake.

This system comprises a canal 3600 feet long, a buried conduit 3100 feet long and a canal 2800 feet long to Konni Lake; a 3000-foot long canal, a 700-foot long buried conduit and a 2300-foot long canal between Konni and Nemaia lakes; a dam on Nemaia Creek backing up water for 3.8 miles to Nemaia Lake; and a 6-mile long canal from this reservoir to the power tunnel intake.

The canals and conduits would be capable of transporting flows of up to 2150 cfs under year-round conditions. Ice free-flow in the canals would be 20 feet deep.

The canal invert would be 16 feet wide and the embankments would be built to a slope of 2:0 horizontal to 1.0 vertical. A 10-foot wide bench would be provided 31 feet above the invert on one embankment and a 12-foot wide service road would be provided on the other.

The conduit sections would each consist of an intake drop-structure, a 14-foot earth covered corrugated metal pipe conduit and a stilling basin outlet. The intake and outlet structures would be constructed of reinforced concrete.

11.5 ARRANGEMENT OF STRUCTURES - (Cont'd)

Nemaia Dam comprises an earthfill embankment, a canal intake structure on the right bank and an emergency spillway on the left bank discharging into Nemaia Creek. The dam would be 480 feet long and a maximum of 80 feet high. The crest would be at El. 3930.5, 15 feet above maximum normal reservoir level. The emergency spillway, consisting of an ungated 18-foot wide ogee section and a baffled discharge chute, would be capable of discharging a flow of 2150 cfs with a 10-foot flood surcharge. The canal intake would be a rectangular concrete structure with invert at El. 3888 and sidewalls 26 feet apart. The structure could be closed with stoplogs lowered through slots provided in the walls.

An emergency side channel spillway would be provided at the downstream end of the final reach of canal, near the power tunnel intake, to provide for unscheduled variations in flow between this point and the flow regulating works located at Elkin Pool about 20 miles away. The side spillway near the end of the last stretch of canals would have a discharge capacity of 2150 cfs with the water surface raising to 2.6 feet above the sill. The structure is of concrete and consists of a 150-foot wide ogee section filled to the embankment of the canal and a baffled discharge chute about 200 feet long which terminates underwater in Chilko Lake.

(c) Power Facilities

The proposed power facilities, comprising the power tunnel, penstock and powerhouse, are shown on Plate 11-6.

The power intake consists of a horizontal inlet section with invert at El. 3881 and a short concrete structure equipped with a fixed wheel gate 13 feet wide x 17.5 feet high and a bulkhead gate of same dimensions.

11.5 ARRANGEMENT OF STRUCTURES - (Cont'd)

The circular power tunnel, 10 1/4 miles long, would be excavated to a nominal diameter of 21.5 feet. It is assumed that 50 percent of the tunnel length would require concrete lining to a nominal diameter of 17.5 feet. The first portion of the power conduit consists of an 800-foot long inclined shaft to convey flows underneath Chilko Lake. A rock trap would be provided near the downstream end of the tunnel, just upstream of a 1/2-mile long, 13-foot diameter, steel-lined tunnel section.

A valve house would be located at the downstream end of the steel tunnel liner, serving as a transition to the steel penstock. The valve house would be equipped with an 11-foot diameter butterfly valve to provide for emergency closure and unit servicing.

The steel penstock would be 11 feet in diameter and 2800 feet long.

The surface powerhouse would house a generating unit comprising a 327.3 rpm Francis turbine rated at 238 000 hp under a net head of 1087 feet, and a generator capable of a maximum continuous output of 175 MW. A pressure relief valve and spherical valve, 10-feet in diameter, would also be provided to permit continuance of flow releases in the event of a powerplant outage.

The SF6 switchgear building would be located above the three single-phase 13.8/500 kV transformers at the rear of the powerhouse. In addition to the generating unit, the switchgear would provide for a 500 kV transmission circuit to the interior as well as another connecting back to the Nude Canyon Project.

11.5 ARRANGEMENT OF STRUCTURES - (Cont'd)

Access to Taseko Lake and the canal system and the powerhouse would require upgrading existing roads of varying standards. The total length of improvements is estimated to be about 50 miles.

11.6 CONSTRUCTION CONSIDERATIONS

As shown on Plate 11-6, the time for completion of the project is estimated to be 4 3/4 years after award of the first contract.

Construction materials for the dams and canals, and concrete aggregate for the concrete structures are assumed to be available within reasonable reach of the individual construction operations.

11.7 ESTIMATE OF COST AND CASH FLOW

Estimated capital costs, in terms of October 1980 prices, are summarized in Table 11-1. As shown, the total cost of the combined diversion and power project is estimated to be $398.8 million, or $2279 per installed kilowatt. The high unit cost indicated is not particularly meaningful since the flow diversion would provide benefits at all mainstem Homathko powerplants.

Estimated annual cash flow related to the construction schedule is summarized in Table 11-2.

SECTION 12.0 - BOWL LAKE PROJECT

12.1 DESCRIPTION OF POWERHOUSE AND TUNNEL SITE AREAS

The Bowl Lake Project, comprising a power intake, tunnel, surge tank and powerhouse, would utilize the head available on the Homathko River between Tatlayoko Lake and the proposed Nude Canyon Reservoir. Plate 12-1 shows details of the Project.

Ground reconnaissance of the specific site areas has not been carried out. Accordingly, site descriptions are based on available mapping and air photography in conjunction with regional information.

The power intake would be located at the end of a small bay on the western shore of Tatlayoko Lake about 1 mile upstream of the lake outlet. At this location there appears to be a steep rocky shoreline probably suitable for the upstream tunnel portal.

The power tunnel would parallel the Homathko River for about 5 1/2 miles within the northwestern mountain slopes on the right river bank, before turning in a southerly direction for 1 mile upstream of the powerhouse site.

The powerhouse site is located at the end of a narrow valley about 1 mile southwest of Bowl Lake. The valley in this area is heavily forested. The slopes above the powerhouse site appear to consist of bedrock with generlly shallow overburden cover. The lower slopes are talus covered.

12.2 GEOLOGICAL FEATURES

Geological knowledge of the power tunnel and powerhouse area is sparse. The following description is based on the 1958 and 1959 reports of the Homathko River by the British Columbia Power Commission.

12.2 GEOLOGICAL FEATURES - (Cont'd)

The tunnel would be located over most of its length in volcanic rocks of breccia, some granite, some shale and greenstone. The downstream tunnel portal would probably be located in greenstone. At mid-length the tunnel would cross a major fault line.

12.3 HEAD FLOW AND POWER

With a maximum normal reservoir level of El. 2743 and an average tailwater level of El. 2439 the maximum gross head would be 304 feet.

Based on the 40-year period 1928 to 1968, the long-term average power flow for Scheme 2 (Taseko Diversion) would be 2113 cfs. This corresponds to approximately 99 percent flow utilization.

With an installed capacity of 75 MW, average annual energy production at a capacity factor of about 59 percent would be 390 million kW.h or 44 average MW.

12.4 ARRANGEMENT OF STRUCTURES

The proposed project general arrangement is shown on Plate 12-1. It comprises the power tunnel, penstock and powerhouse solely with impounding and regulating works provided by the Tatlayoko Storage Project, described in Section 7.0.

The power intake consists of a horizontal tunnel at invert El. 2675 and a low reinforced concrete shaft equipped with a fixed wheel gate 14.6 feet wide x 22 feet high, and provisions for stop log closure.

The power tunnel, 6 1/2 miles long, would be of modified horseshoe shape and fully concrete lined to a nominal diameter of

12.4 ARRANGEMENT OF STRUCTURES - (Cont'd)

20 feet. An 80-foot diameter concrete lined surge shaft would be constructed at the downstream end of the power tunnel to improve generating unit regulation.

The penstock, 660 feet in length, would comprise an upstream concrete lined shaft 16.3 feet in diameter and a downstream 400-foot long, 16-foot diameter, steel-lined section terminating at a 15-foot diameter butterfly valve located immediately upstream of the turbine.

The surface powerhouse would contain a generating unit consisting of a 163.6 rpm Francis turbine rated at 102 000 hp under a net head of 275 feet, and a generator capable of a maximum continuous output of 75 MW.

The SF-6 switchgear building would be located above a 3-phase 13.8/500 kV transformer at the rear of the powerhouse. In addition to the generating unit, the switchgear would provide for 500 kV transmission circuits to the Tatlayoko Lake powerhouse and to the Nude Canyon-Mosely Lake powerhouse.

Access to the power intake would require construction of a 1-mile long road crossing Ottarasko Creek, and access to the powerhouse would require construction of 6 miles of road through the Homathko Valley, both commencing at the Tatlayoko Lake storage dam.

12.5 CONSTRUCTION CONSIDERATIONS

As shown on Plate 12-1, the time required for final design and construction is estimated to be 4 3/4 years after award of the first contract.

Concrete aggregate for this project may have to be manufactured from granitic rocks on the right bank of the valley near the dam

12.5 CONSTRUCTION CONSIDERATIONS - (Cont'd)

at the south end of Tatlayoko Lake. However, natural aggregate deposits may be discovered during the course of future exploration work.

12.6 ESTIMATE OF COST AND CASH FLOW

Estimated capital costs are summarized in Table 12-1. As shown, the total cost for the development is estimated to be $135.6 million or $1808 per installed kilowatt.

Estimated annual cash flow related to the construction schedule is summarized in Table 12-2.

SECTION 13.0 - CHILKO LAKE DIVERSION

13.1 GENERAL

For location of Chilko Lake and Chilko River refer to Plate 3-1. The Chilko River is a prominant tributary of the Fraser River, via its confluence with the Chilcotin River about 45 miles downstream from Chilko Lake and the Chilcotin River confluence with the Fraser River another 53 miles downstream.

It is reported by Fisheries and Oceans that the Chilko River system supports a salmon fishery second only to that of the Adams River system. They have stated that the Chilko River supports 30 percent of the Fraser River sockeye and that the Chilko River also supports an important Chinook salmon fishery. The majority of the salmon spawn in the river reach immediately downstream from the lake outlet; however, a significant portion of the adult salmon migrate into Chilko Lake to spawn along its shoreline. The sockeye fry which originate from the upstream reach of the Chilko River typically migrate upstream into Chilko Lake for rearing.

13.2 DIVERSION LIMITATIONS DUE TO SALMON FISHERY

According to Fisheries and Oceans, specific limitations imposed on any scheme to divert flows from Chilko Lake to Tatlayoko Lake would comprise, at least, the following:

1. No control works at the outlet of Chilko Lake because of the importance of this waterway to upstream and downstream migration of adult and juvenile salmon.

2. Diversion of flows only in periods when excess water would be available, in terms of fishery requirements for spawning, incubation and migration.

13.2 DIVERSION LIMITATIONS DUE TO SALMON FISHERY - (Cont'd)

3. No diversion of Taseko Lake flows into Chilko Lake, primarily because the high degree of turbidity of Taseko Lake water by comparison to the clear water of Chilko Lake.

4. Diversion flows, when available, to be passed through a barrier or screens at sufficiently low velocity to ensure that juvenile fish will not be attracted to the intake area.

Fisheries and Oceans have expressed their general opposition to any scheme involving diversion of flows from Chilko Lake.

13.3 POTENTIAL ENERGY PRODUCTION FROM PARTIAL CHILKO DIVERSION

For purposes of the Energy Board Report an average Chilko Lake flow diversion of 408 cfs was assumed. This represents about 26 percent of the long term average outflow from Chilko Lake of 1579 cfs. Assuming this diversion flow could be regulated for timely energy production at the Tatlayoko Lake, Bowl Lake, Nude Canyon and Waddington powerhouses, energy production from development Scheme 2 (Taseko Diversion) could be enhanced by 10.8 percent, or an additional 83 avg MW. On this basis, the overall energy increase would be 8.7 percent including the Mosley Creek Project.

However, because of limitations which would prevent regulating diversion flows on Chilko Lake itself, which would make diversion flows available only when considered to be in excess by Fisheries and Oceans, and because of inability to regulate these diversion flows on Tatlayoko Lake without a further large increase in the storage range on this lake, the additional energy produced at the Homathko plants would obviously be classified as non-firm.

It appears probable that flows excessive to fishery requirements may generally occur in the period June to August, when least

13.3 POTENTIAL ENERGY PRODUCTION FROM PARTIAL CHILKO DIVERSION - (Cont'd)

required for energy production. It also appears probable that there would be some years when flows would not be considered adequate by Fisheries to permit any flow diversion for a portion or all of these months. Considering the above, and diversion limitations in general, an average flow diversion of 26 percent would appear optimistic. In the extreme, it is possible that no flow diversion from Chilko Lake would be permitted.

13.4 DIVERSION COSTS

In view of the highly speculative nature of the extent, if any, of an average flow diversion from Chilko Lake, the extreme of flow variability implicit in an unregulated average diversion flow, and the uncertainty concerning the value of energy produced from any permitted diversion, no attempt has been made to quantify the cost of any particular Chilko Lake diversion scheme.

In qualitative terms, any increase of the average diversion flow above that considered in Scheme 2 (Taskeo Diversion) will result in a disproportionately large increase in cost of the Tatlayoko Lake power tunnel and other power facilities. This large increase in costs would result from need to design the power facilities for the maximum flow diversion in order to accommodate the unregulated average flow diversion. This is unlike the Taseko Diversion where the flows are largely regulated through storage on Taseko Lake. Similarly, there would be a disproportionally large increase in generation costs at the downstream power generation projects to the extent the Chilko Lake flows would remain unregulated within the Homathoko River system.

SECTION 14.0 - CONCLUSIONS AND RECOMMENDATIONS

14.1 CONCLUSIONS

For the Scheme 1 non-diversion development, comprising upstream storage on Tatlayoko Lake, generation projects at Nude and Waddington canyons, and a combined storage and generation project on Mosley Creek, the power potential and costs are summarized as follows:

Installed Capacity*	-	900 MW
Average Energy Production	-	544 avg MW
Total Capital Cost***	-	$1221 million
Capacity Cost***	-	$1357/kW
Energy Cost***	-	$2245/avg kW

For the Scheme 2 development involving complete diversion of Taseko Lake flows into the Homathko River system via an additional generating station on the Tatlayoko Lake shoreline and increased capacity at the two Homathko River generation projects, the power potential and costs are similarly presented as follows:

Installed Capacity**	-	1470 MW
Average Energy Production	-	909 avg MW
Total Capital Cost***	-	$1724 million
Capacity Cost***	-	$1173/kW
Energy Cost***	-	$1897/avg kW

An additional generation project, designated as Bowl Lake, could be developed in conjunction with Scheme 2 for development of the

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* 60 percent Capacity Factor.

** 60 percent Capacity Factor except for Tatlayoko Lake generating station with 75 percent Capacity Factor.

*** October 1980 price levels excluding corporate overhead and interest during construction.

14.1 CONCLUSIONS - (Cont'd)

head between the Nude Canyon reservoir and Tatlayoko Lake. The Bowl Lake Project would add 75 MW of installed capacity and 44 avg MW of energy to Scheme 2 at an additional cost of $136 million or $1808 per installed kilowatt. This project as described herein is based on particularly limited site information.

The total power potential and costs of the modified Scheme 2, with the Bowl Lake Project, are summarized following:

Installed Capacity*	-	1545 MW
Average Energy Production	-	953 avg MW
Total Capital Cost**	-	$1860 million
Capacity Cost**	-	$1204/kW
Energy Cost**	-	$1951/avg kW

The construction periods from first contract award to first in-service date on 1 October of a given year are estimated to be as follows:

Project	Construction Period (Years)
Tatlayoko Storage	2 1/2
Nude Canyon	6 3/4
Mosley Creek	5 3/4
Waddington	6 3/4
Taseko-Tatlayoko Diversion	4 3/4
Bowl Lake	4 3/4

It is assumed that approval to proceed with the projects would be obtained at least 6 months prior to first contract award.

The sequence of development for preferred Scheme 2 would likely be as follows:

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* 60 percent Capacity Factor.

** October 1980 price level excluding corporate overhead and interest during construction.

14.1 CONCLUSIONS - (Cont'd)

1. Nude Canyon, Tatlayoko Storage, Taseko Diversion to be in-service closely together.

2. Mosley Creek.

3. Waddington.

4. Bowl Lake.

For Scheme 1 the sequence of development would likely be as follows:

1. Mosley Creek.

2. Waddington, Tatlayoko Storage to be in-service closely together.

3. Nude Canyon.

Complete diversion of Taseko Lake flows has been assumed for Scheme 2. It is possible that some level of flow releases past the diversion dam into the Taseko River would have to be maintained. Unit costs of energy would accordingly be greater than indicated above with such flow releases. In addition, it is possible that facilities for passing adult and juvenile salmon over Taseko Dam may be required; and that remedial measures or compensation for any loss of natural salmon production, either upstream or downstream of Taseko Dam may also be required. No special provisions have been included in the capital cost estimates for such potential environmental costs, and the unit costs of energy would be increased in accordance with any requirement for such compensatory or remedial measures.

Furthermore, no special environmental or socio-economic costs have been included in the capital cost estimates for potential losses

14.1 CONCLUSIONS - (Cont'd)

which could occur with development of the Homathko River with or without flow diversion. In particular, environmental and socio-economic costs may be a major consideration along the Taseko-Tatlayoko Lake diversion route where four Indian reserves would be affected by canals and, in one instance, by partial flooding within a reservoir.

Diversion of a portion of Chilko Lake flows has also been considered. However, in view of the importance of this lake and the river immediately downstream to the Fraser River salmon fishery, with attendant severe limitations which would probably be imposed on any possible flow diversion, no Chilko Lake diversion scheme has been presented in this report. The most severe limitations would entail diversion only when water was excessive to fisheries requirements and without the benefit of flow regulation by Chilko Lake. Accordingly, downstream diversion and powerhouse facilities would have to be sized disproportionally large relative to the average diversion flow to accommodate maximum flows. By comparison, Taseko Lake diversion flows would be largely regulated by lake storage before downstream conveyance.

From comparison of costs with and without the Taseko Lake flow diversion, the importance of this diversion to the economics of the Homathko River development is evident. Further studies should be directed towards optimizing this diversion, taking into account the environmental and socio-economic impacts as well as the energy benefits.

14.2 RECOMMENDATIONS

1. If a decision is made to proceed with feasibility studies, it is recommended that investigations concentrate initially on Scheme 1, the basic four dam scheme with no diversion of Taseko water. An environmental impact study of the Taseko diversion should be made to establish the environmental feasibility and cost of diversion. The economics of Taseko diversion flows less than 100 percent should be investigated, and the maximum acceptable diversion be

established through multi-disciplinary studies. Emphasis should be placed on investigating all possible means of Taseko diversion flow conveyance to minimize social impacts along the diversion route.

2. It is recommended that the Bowl Lake Project be investigated to a level comparable to that for the Scheme 2 generation projects.

3. Apart from further refinement of arrangements, possibly with some axis relocations, and greater elaboration in estimating construction costs, additional studies will be necessary to select plant capacities and reservoir levels for all projects, and to firm up storage capacity and drawdown requirements for the Mosley Creek reservoir and for Tatlayoko and Taseko lakes.

4. Subsurface investigations in terms of drilling and geophysical surveys will be required to varying degrees at all sites, to assess suitability of the foundation rocks and to determine depths of overburden. Detailed site specific geological mapping should be carried out in conjunction with a broad program of regional geological mapping. The nature and competence of the rock formations through which the five major power and flow diversion tunnels would be located merit particular attention during these geological investigations.

5. A comprehensive construction materials exploration program should be conducted to identify the concrete aggregate and damfill borrow sources and the characteristics of these materials for all projects under consideration.

6. Topographic mapping at suitable metric scales and contour intervals would be required for all site specific areas (possibly

1:2000 scale with 2 m contours), and for general project areas (possibly 1:10 000 scale with 5 m contours).

7. It is recommended that detailed hydrologic studies be undertaken to firm up the spillway and construction-diversion design floods. A review should be made of the adequacy of the meteorological and hydrometric network for definition of areal variations in precipitation and runoff within the basin. In addition, all project streamflows should be updated to the current study period for use in ongoing power studies. The effect of glacier runoff on long-term average streamflows merits particular consideration.

8. A program of river ice observations and measurement of suspended sediment should be established, with particular accent on ice observation in the vicinity and upstream of all generation projects and on sediment measurements upstream of the Mosley Creek Project.

   The objective of the ice observation program would be to identify patterns of freeze-up and break-up, to record relevant temperature and ice thickness data, and to identify locations of hanging dams in the proposed project area.

   The objective of the sediment measuring program would be to provide data for study of reservoir sedimentation rates as well as effects on the downstream river morphology due to upstream sediment entrapment.

9. Finally, it is recommended that a river regime and morphology study be undertaken of the Homathko River down to its estuary at Bute Inlet. The objective of this study would be to establish baseline information and to assess the effects of proposed upstream flow regulation on the regime of the downstream reaches of the river.

TABLE 3-1

HOMATHKO OVERVIEW STUDY
PRINCIPAL PROJECT DATA

Item	Tatlayoko Storage	Nude Canyon	Mosley Creek	Waddington	Taseko-Tatlayoko Diversion	Bowl Lake
Dams						
Type	Earthfill	Earthfill	Concrete gravity	Concrete Arch	Earthfill	
Maximum height (crest length)(ft)	85 (2800)	680 (1600)	450 (1580)	655 (1040)	215 (1150)	
Spillway						
PMF Design Capacity (cfs)	15 000	40 000	55 000	135 000	20 000	
Diversion						
Design Capacity (cfs)	5 500	10 000	12 000	40 000	8 000	
Reservoir						
Maximum flood level (ft)	2 748	2 450	2 580	1 080	4 405	
Maximum normal level (ft)	2 743	2 440	2 560	1 070	4 395	
Average level (ft)	2 733	2 439	2 518	1 069	--	
Minimum level (ft)	2 710	2 435	2 460	1 065	4 350	
Surface area (acres)	11 250	2 460 *	9 000	1 900	15 000	
Total storage (acre feet)	--	--	1 400 000	335 000	--	
Live storage (acre feet)	335 000	12 270 *	799 000	9 000	520 000	
Average Tailwater Level (ft)	--	1 069	1 069	467	2 733	2 439
Power Facilities[1]						
Scheme 1 (Non-diversion)						
Total plant capacity (MW)		240	300	360		
Units, no. and capacity (MW)		1-240	2-150	2-180		
Scheme 2 (Taseko Diversion)						
Total plant capacity (MW)		500	300	495	175	75
Units, no. and capacity (MW)		2-250	2-150	3-165	1-175	1-75
Units rotating speed (rpm)		300	360	240	327.3	163.6
Design net head (ft)		1242	1329	586	1087	275
Total rated plant discharge (cfs)		5110	3150	11 000	2150	3780

[1] Power facilities based on approximate capacity factor of 60 percent for all projects except the Taseko-Tatlayoko Diversion Project for which the capacity is 75.4 percent.

* Revised May 1983

TABLE 4-1

MONTHLY OVERVIEW STUDY
AVERAGE MONTHLY PROJECT STREAMFLOWS

AVERAGE MONTHLY STREAMFLOW[1]
(cfs)

	Project				
Month	Tatlayoko Storage	Nude Canyon	Mosley Creek	Waddington	Taseko[2] Diversion
January	158	509	422	1 091	391
February	118	380	400	1 234	396
March	119	382	333	1 008	301
April	127	411	521	1 621	379
May	468	1511	1723	4 618	1753
June	959	3095	3595	9 971	4210
July	1146	3695	4894	13 484	4381
August	1040	3356	4209	12 029	3775
September	673	2173	2504	7 136	2340
October	423	1363	1451	4 235	887
November	269	868	637	1 973	562
December	158	511	600	1 470	460
YEARLY AVERAGE	472	1521	1774 *	4 989	1653

1 For 40-year period January 1928 to December 1968.

2 Includes runoff from Konni and Nemaia lakes which is 7.1 percent of Taseko Lake outflow.

* Revised May 1983

TABLE 4-2

HOMATHKO BASIN - FLOOD FLOWS

Site	Flood Discharges - 1000 cfs							
	Recurrence Interval - Years							
	2.33	10	25	30[2]	50	100	PMF[1]	Spillway Design
Waddington	20	33	40	40	45	50	135	135
Nude Canyon	5.7	8	9	10	10	11	40	40
Tatlayoko Lake Storage	3.5	4.6	5.3	5.5	5.8	6.0	15	15
Mosley Creek	7.7	10	11	12	13	15	55	55
Taseko Diversion	5.0	6.6	7.6	8.0	8.3	9.0	20	20

[1] PMF figures correspond to natural or unregulated floods.

[2] Diversion design floods.

TABLE 5-1

HOMATHKO OVERVIEW STUDY
POWER STUDY DATA

	Reservoir Levels			Head			Live Storage	1928-1968 Average Flows (cfs)		Total Installed Capacity (MW)	Average Energy (Av. MW)
	Maximum Normal (ft)	Minimum (ft)	Average Tailwater Level (ft)	Maximum Gross (ft)	Design Gross[1] (ft)	Design Net[2] (ft)	(ac-ft x 10^3)	Streamflow	Power Flow[3]		
Scheme 1 (Non-diversion)											
Tatlayoko Storage	2743	2710	2440	-	-	-	335	472	-	-	-
Nude Canyon	2440	-	1069	1371	1371	1242	0	1521	1477	240	144
Mosley Creek	2560	2460	1069	1490	1449	1329	799	1774	1770	300	181
Waddington	1070	1065	467	603	599	586	9	4989	4860	360	219
									TOTAL SCHEME 1	900	544
Scheme 2 (Taseko Diversion)											
Taseko-Tatlayoko Diversion	3914	-	2733	1204	1181	1087	-	1653	1653	175	132
Tatlayoko Storage	2743	2710	-	-	-	-	335	2125	-	-	-
Nude Canyon	2440	2435	1069	1371	1371	1242	24	3174	3148	500	300
Mosley Creek	2560	2460	1069	1490	1449	1329	799	1744	1720	300	181
Waddington	1070	1065	467	603	598	586	9	6642	6556	495	296
									TOTAL SCHEME 2	1470	909
Bowl Lake (Optional)	2743	2710	2439	303	294	275	335	2125	2113	75	44
									TOTAL SCHEME 2 WITH BOWL LAKE	1545	953

1 Design gross head is the maximum gross head less long-term average drawdown, where applicable.

2 Design net head is the design gross head less hydraulic losses with turbine full gate discharge under this design net head.

3 Power flow is the long-term average flow passed through the turbines

TABLE 7-1

HOMATHKO OVERVIEW STUDY
TATLAYOKO STORAGE PROJECT

ESTIMATE OF CAPITAL COSTS
($ Millions)

1.	Land and Rights	0.2
2.	Flowage	2.3
3.	Area Access	0.3
4.	Construction Services	0.9
5.	Site Clearing	0.3
6.	Site Access	1.1
7.	Dam Outlet Works	-
8.	Earthfill Dam and Spillway	15.3
9.	Ottarasko Dam and Canal	0.1
	TOTAL DIRECT COST	20.5
10.	Contingencies	4.1
11.	Engineering, Investigation and Supervision	2.2
12.	Construction Insurance and Bonds	0.3
	TOTAL CAPITAL COST	27.1

Note: Costs are based on October 1980 prices. The estimates include costs for reservoir clearing and flooding of existing facilities; other environmental or social costs associated with the project are not included. Interest during construction and corporate overhead costs are also not included.

TABLE 7-2

HOMATHKO OVERVIEW STUDY
TATLAYOKO STORAGE PROJECT

ESTIMATE OF CAPITAL EXPENDITURES BY FISCAL YEARS
($ Millions)

Fiscal Year[1]	Annual Capital Expenditures[2]
0/1	0.4
1/2	0.5
2/3	14.4
3/4	11.8

---

1 Fiscal year is 1 April to 31 March.

2 All costs are based on October 1980 price levles. For other footnotes see Table 7-1.

TABLE 8-1

HOMATHKO OVERVIEW STUDY
NUDE CANYON PROJECT
WITH NON-DIVERSION SCHEME 1

(240 MW Installed Capacity)

ESTIMATE OF CAPITAL COSTS
($ Millions)

1.	Land and Rights	0.5
2.	Flowage	2.1
3.	Area Access	9.6
4.	Construction Services	11.4
5.	Site Access	33.1
6.	Site Clearing	0.4
7.	Diversion Tunnel and Cofferdams	9.6
8.	Earthfill Dam	143.8
9.	Spillway	11.7
10.	Power Intake	1.2
11.	Power Tunnel and Surge Shaft	25.8
12.	Penstock and Valve House	17.6
13.	Powerhouse and Switchyard - Civil	7.6
	- Mechanical	8.9
	- Electrical	18.6
	TOTAL DIRECT COST	301.9
14.	Contingencies	56.5
15.	Engineering, Investigation and Supervision	32.2
16.	Construction Insurance and Bonds	3.9
	TOTAL CAPITAL COST	394.5

Note: Costs are based on October 1980 prices. The estimates include costs for reservoir clearing and flooding of existing facilities; other environmental or social costs associated with the project are not included. Interest during construction and corporate overhead costs are also not included.

TABLE 8-2

HOMATHKO OVERVIEW STUDY
NUDE CANYON PROJECT
WITH TASEKO DIVERSION SCHEME 2

(500 MW Installed Capacity)

ESTIMATE OF CAPITAL COSTS
($ Millions)

1.	Land and Rights	0.5
2.	Flowage	2.1
3.	Area Access	9.6
4.	Construction Services	13.6
5.	Site Access	33.1
6.	Site Clearing	0.4
7.	Diversion Tunnel and Cofferdams	9.6
8.	Earthfill Dam	143.8
9.	Spillway	11.7
10.	Power Intake	1.6
11.	Power Tunnel and Surge Shaft	41.9
12.	Penstock and Valve House	30.6
13.	Powerhouse and Switchyard - Civil	11.3
	- Mechanical	14.2
	- Electrical	29.7
	TOTAL DIRECT COST	353.7
14.	Contingencies	65.2
15.	Engineering, Investigation and Supervision	37.8
16.	Construction Insurance and Bonds	4.6
	TOTAL CAPITAL COST	461.3

Note: Costs are based on October 1980 prices. The estimates include costs for reservoir clearing and flooding of existing facilities; other environmental or social costs associated with the project are not included. Interest during construction and corporate overhead costs are also not included.

TABLE 8-3

HOMATHKO OVERVIEW STUDY
NUDE CANYON PROJECT
WITH TASEKO DIVERSION SCHEME 2

(500 MW Installed Capacity)

ESTIMATE OF CAPITAL EXPENDITURES BY FISCAL YEARS
($ Millions)

Fiscal Year[1]	Annual Capital Expenditures[2]
0/1	5.2
1/2	31.6
2/3	43.9
3/4	30.8
4/5	89.5
5/6	127.7
6/7	110.5
7/8	22.1

---

1 Fiscal year is 1 April to 31 March.

2 All costs are based on October 1980 price levels. For other footnotes see Table 8-2.

TABLE 9-1

HOMATHKO OVERVIEW STUDY
MOSLEY CREEK PROJECT

(300 MW Installed Capacity)

ESTIMATE OF CAPITAL COSTS
($ Millions)

1.	Land and Rights	0.5
2.	Flowage	14.5
3.	Area Access	23.0
4.	Construction Services	12.4
5.	Site Access	3.8
6.	Site Clearing	0.7
7.	Diversion Tunnel and Cofferdams	11.8
8.	Concrete Gravity Dam (Incl. Power Intake) and Spillway	126.6
9.	Power Tunnel and Surge Shaft	60.8
10.	Penstocks and Valve House	26.4
11.	Powerhouse and Switchyard - Civil	9.1
	- Mechanical	10.2
	- Electrical	22.1
	TOTAL DIRECT COST	321.9
12.	Contingencies	60.3
15.	Engineering, Investigation and Supervision	34.4
16.	Construction Insurance and Bonds	4.9
	TOTAL CAPITAL COST	421.5

Note: Costs are based on October 1980 prices. The estimates include costs for reservoir clearing and flooding of existing facilities; other environmental or social costs associated with the project are not included. Interest during construction and corporate overhead costs are also not included.

TABLE 9-2

HOMATHKO OVERVIEW STUDY
MOSLEY CREEK PROJECT

(300 MW Installed Capacity)

ESTIMATE OF CAPITAL EXPENDITURES BY FISCAL YEARS
($ Millions)

Fiscal Year[1]	Annual Capital Expenditures[2]
0/1	6.1
1/2	21.1
2/3	20.9
3/4	75.8
4/5	119.5
5/6	129.7
6/7	48.4

---

1 Fiscal year is 1 April to 31 March.

2 All costs are based on October 1980 price levels. For other footnotes see Table 9-1.

TABLE 10-1

HOMATHKO OVERVIEW STUDY
WADDINGTON PROJECT
WITH NON-DIVERSION SCHEME 1

(360 MW Installed Capacity)

ESTIMATE OF CAPITAL COSTS
($ Millions)

1.	Land and Rights	0.4
2.	Flowage	4.8
3.	Construction Services	12.3
4.	Area Access	7.9
5.	Site Access (Incl. Access Tunnels)	22.4
6.	Site Clearing	0.2
7.	Diversion Tunnel and Cofferdams	10.4
8.	Arch Dam	147.8
9.	Power Intakes	5.3
10.	Penstocks	8.6
11.	Powerhouse, Transformer Chamber and Switchyard - Civil	19.8
	- Mechanical	13.6
	- Electrical	28.9
12.	Tailrace Manifold and Tunnel	8.9
	TOTAL DIRECT COST	291.3
13.	Contingencies	51.4
15.	Engineering, Investigation and Supervision	30.8
16.	Construction Insurance and Bonds	4.5
	TOTAL CAPITAL COST	378.0

Note: Costs are based on October 1980 prices. The estimates include costs for reservoir clearing and flooding of existing facilities; other environmental or social costs associated with the project are not included. Interest during construction and corporate overhead costs are also not included.

TABLE 10-2

HOMATHKO OVERVIEW STUDY
WADDINGTON PROJECT
WITH TASEKO DIVERSION SCHEME 2

(495 MW Installed Capacity)

ESTIMATE OF CAPITAL COSTS
($ Millions)

1.	Land and Rights	0.4
2.	Flowage	4.8
3.	Construction Services	12.3
4.	Area Access	7.9
5.	Site Access (Incl. Access Tunnels)	22.4
6.	Site Clearing	0.2
7.	Diversion Tunnel and Cofferdams	10.4
8.	Arch Dam	147.8
9.	Power Intakes	7.0
10.	Penstocks	13.2
11.	Powerhouse, Transformer Chamber and Switchyard - Civil	26.1
	- Mechanical	18.0
	- Electrical	38.5
12.	Tailrace Manifold and Tunnel	11.1
	TOTAL DIRECT COST	320.1
13.	Contingencies	56.5
15.	Engineering, Investigation and Supervision	33.9
16.	Construction Insurance and Bonds	4.9
	TOTAL CAPITAL COST	415.4

Note: Costs are based on October 1980 prices. The estimates include costs for reservoir clearing and flooding of existing facilities; other environmental or social costs associated with the project are not included. Interest during construction and corporate overhead costs are also not included.

TABLE 10-3

HOMATHKO OVERVIEW STUDY
WADDINGTON PROJECT
WITH TASEKO DIVERSION SCHEME 2

(495 MW Installed Capacity)

ESTIMATE OF CAPITAL EXPENDITURES BY FISCAL YEARS
($ Millions)

Fiscal Year[1]	Annual Capital Expenditures[2]
0/1	2.8
1/2	12.6
2/3	15.6
3/4	26.2
4/5	70.1
5/6	123.1
6/7	105.8
7/8	43.0
8/9	16.2

---

1 Fiscal year is 1 April to 31 March.

2 All costs are based on October 1980 price levels. For other footnotes see Table 10-2.

TABLE 11-1

HOMATHKO OVERVIEW STUDY
TASEKO-TATLAYOKO DIVERSION PROJECT

(175 MW Installed Capacity)

ESTIMATE OF CAPITAL COSTS
($ Millions)

1.	Land and Rights	0.5
2.	Area Access	9.9
3.	Construction Services	11.7
4.	Site Access	0.4
5.	Site Clearing	1.2
6.	Taseko Diversion Dam	28.6
7.	Taseko-Tatlayoko Diversion and Powerplant	251.2
	TOTAL DIRECT COST	303.5
8.	Contingencies	58.1
9.	Engineering, Investigations and Supervision	32.5
10.	Construction Insurance and Bonds	4.7
	TOTAL CAPITAL COST	398.8

Note: Costs are based on October 1980 prices. The estimates include costs for reservoir clearing and flooding of existing facilities; other environmental or social costs associated with the project are not included. Interest during construction and corporate overhead costs are also not included.

TABLE 11-2

HOMATHKO OVERVIEW STUDY
TASEKO-TATLAYOKO DIVERSION PROJECT

(175 MW Installed Capacity)

ESTIMATE OF CAPITAL EXPENDITURES BY FISCAL YEARS
($ Millions)

Fiscal Year[1]	Annual Capital Expenditures[2]
0/1	4.0
1/2	2.7
2/3	42.0
3/4	103.3
4/5	179.4
5/6	67.4

---

1 Fiscal year is 1 April to 31 March.

2 All costs are based on October 1980 price levels. For other footnotes see Table 11-1.

TABLE 12-1

HOMATHKO OVERVIEW STUDY
BOWL LAKE PROJECT
WITH TASEKO DIVERSION SCHEME 2

(75 MW Installed Capacity)

ESTIMATE OF CAPITAL COSTS
($ Millions)

1.	Construction Services	4.1
2.	Power Intake	1.9
3.	Power Tunnel and Surge Shaft	74.1
4.	Penstocks	4.5
5.	Powerhouse and Switchyard - Civil	2.8
	- Mechanical	8.4
	- Electrical	8.3
	TOTAL DIRECT COST	104.1
6.	Contingencies	18.9
7.	Engineering, Investigation and Supervision	11.1
8.	Construction Insurance and Bonds	1.5
	TOTAL CAPITAL COST	135.6

Note: Costs are based on October 1980 prices. The estimates include costs for reservoir clearing and flooding of existing facilities; other environmental or social costs associated with the project are not included. Interest during construction and corporate overhead costs are also not included.

TABLE 12-2

HOMATHKO OVERVIEW STUDY
BOWL LAKE PROJECT
WITH TASEKO DIVERSION SCHEME 2

(75 MW Installed Capacity)

ESTIMATE OF CAPITAL EXPENDITURES BY FISCAL YEARS
($ Millions)

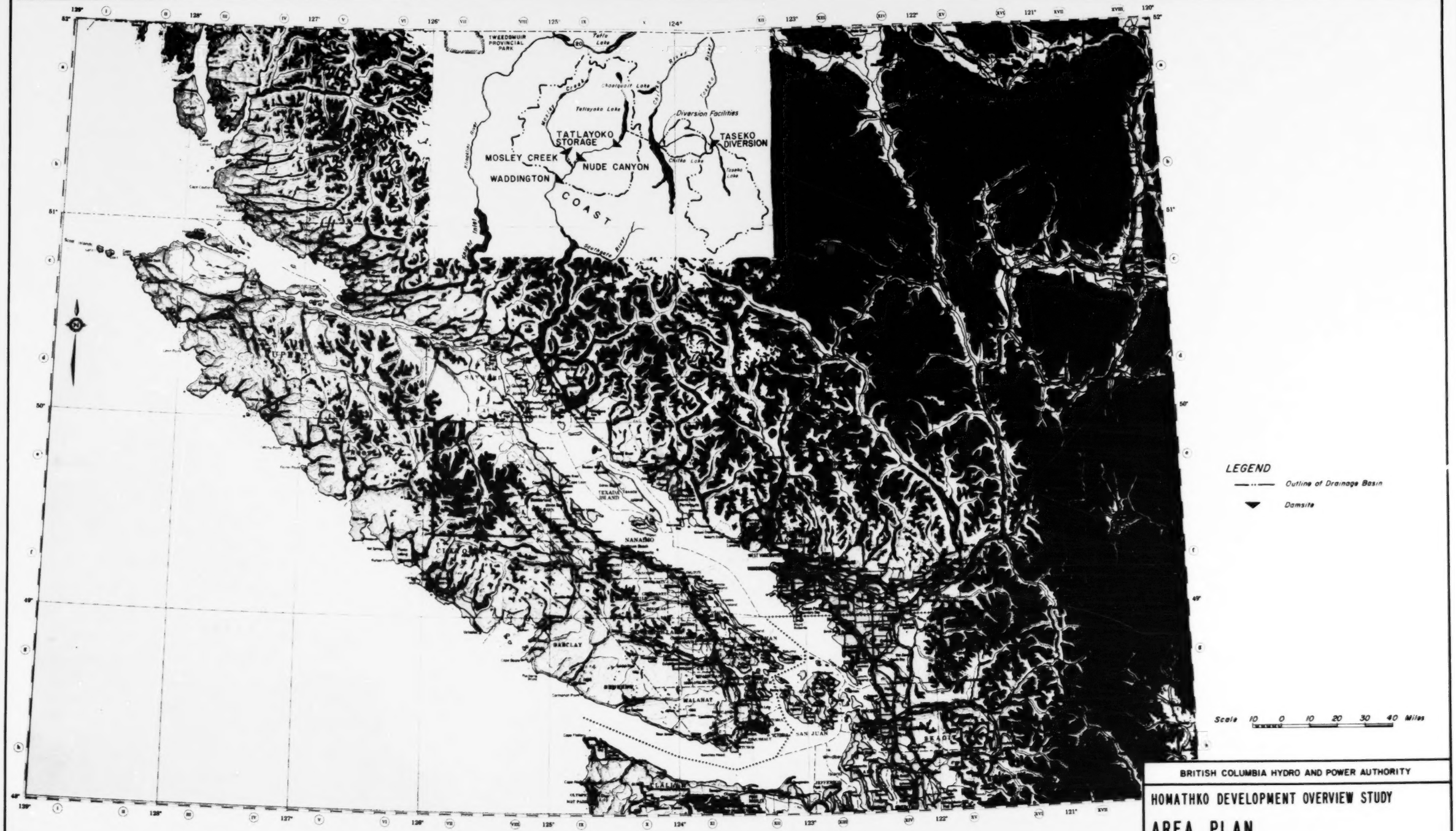
Fiscal Year[1]	Annual Capital Expenditures[2]
0/1	1.5
1/2	8.5
2/3	14.5
3/4	35.0
4/5	53.1
5/6	23.0

---

1 Fiscal year is 1 April to 31 March.

2 All costs are based on October 1980 price levels. For other footnotes see Table 12-1.

PLATES

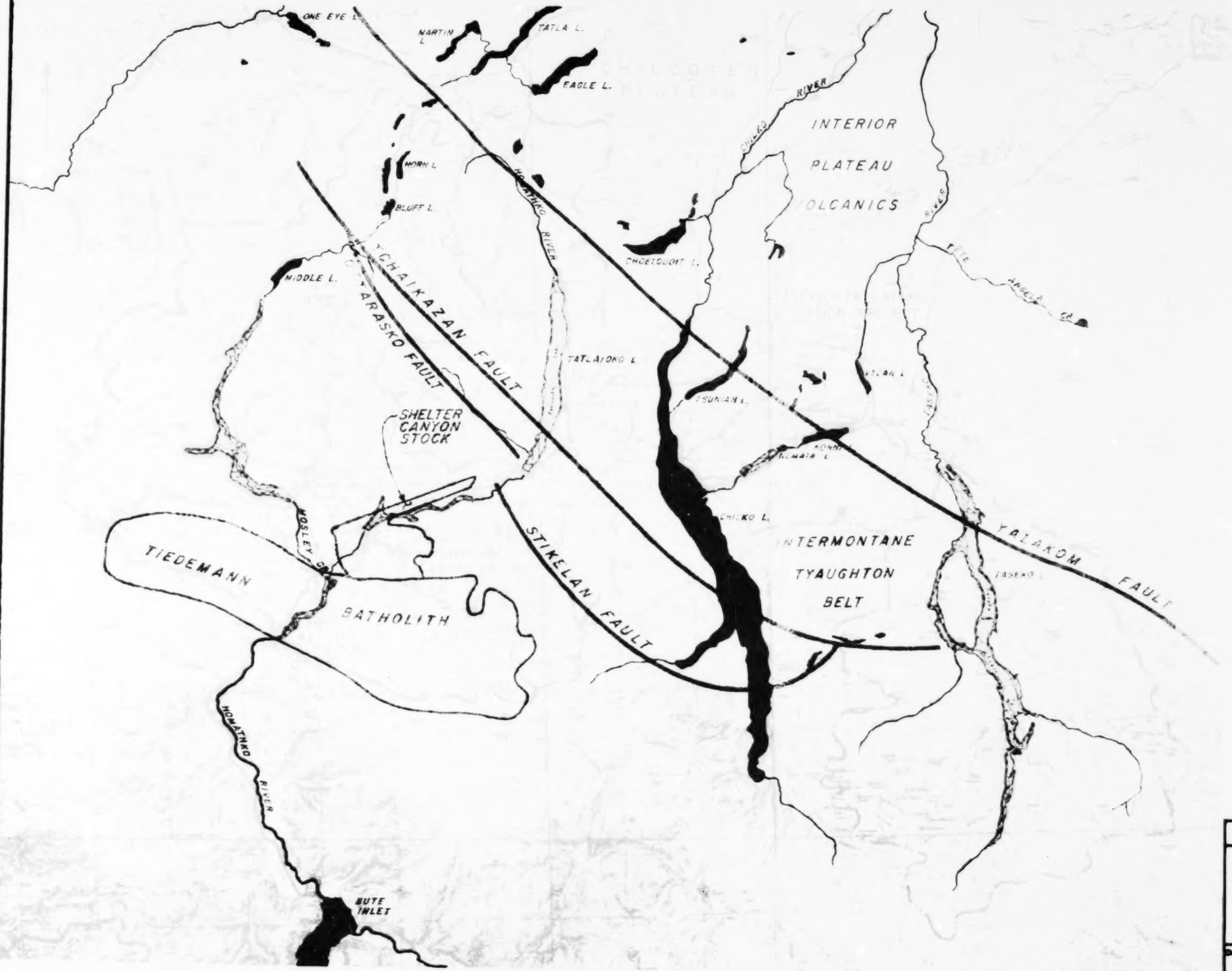


BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HOMATHKO DEVELOPMENT OVERVIEW STUDY

AREA PLAN

DATE JUN 1981	PLATE 2-1	R
DWN D.J.	DWG No. 704 - C14 - D1	

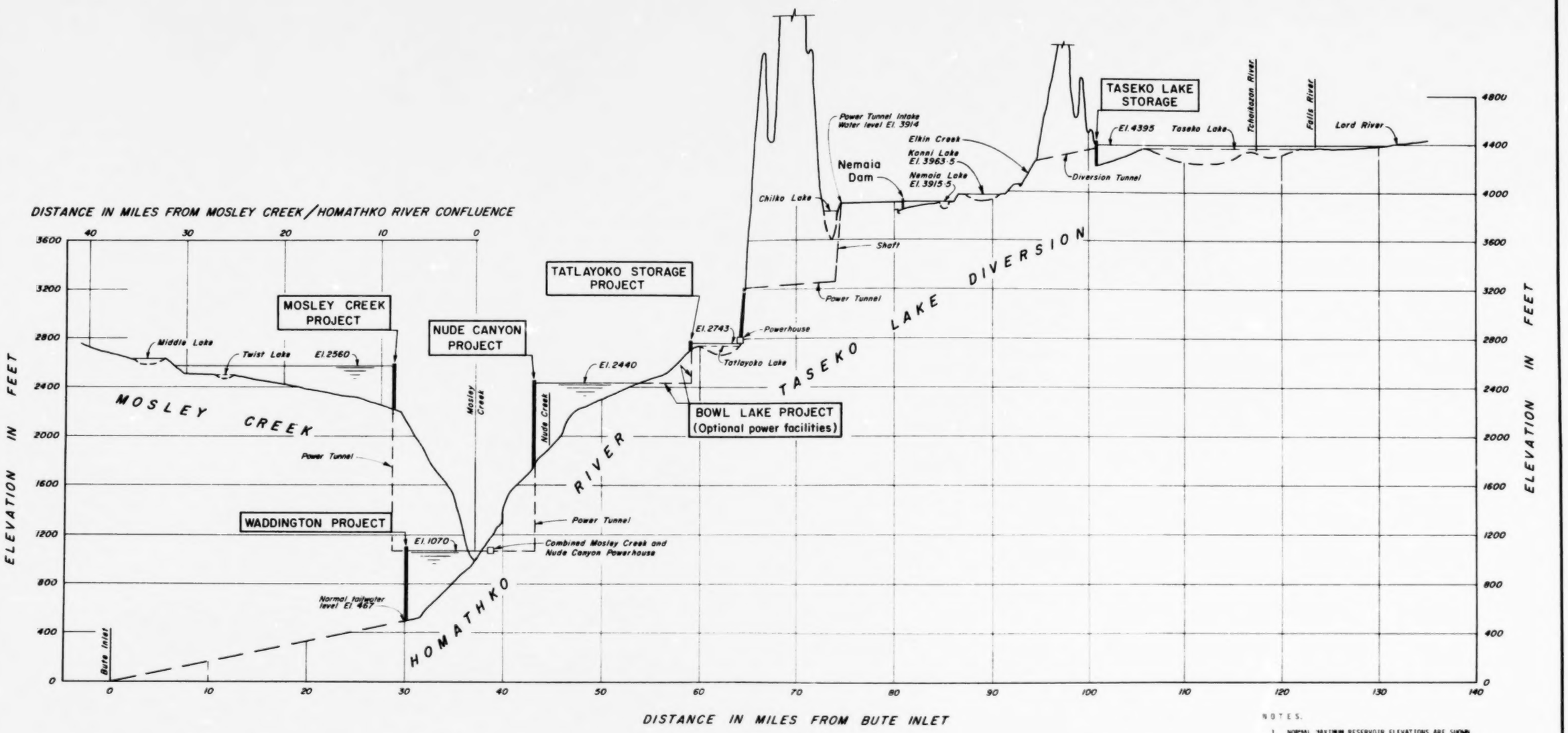


BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HOMATHKO DEVELOPMENT OVERVIEW STUDY

PROJECT LOCATIONS, AREA ACCESS AND REGIONAL GEOLOGY

DATE	PLATE	
JUN 1981	PLATE 3-1	R
DES. D.A.J. / K.L.	DWG No. 704-C14 D2	



NOTES.

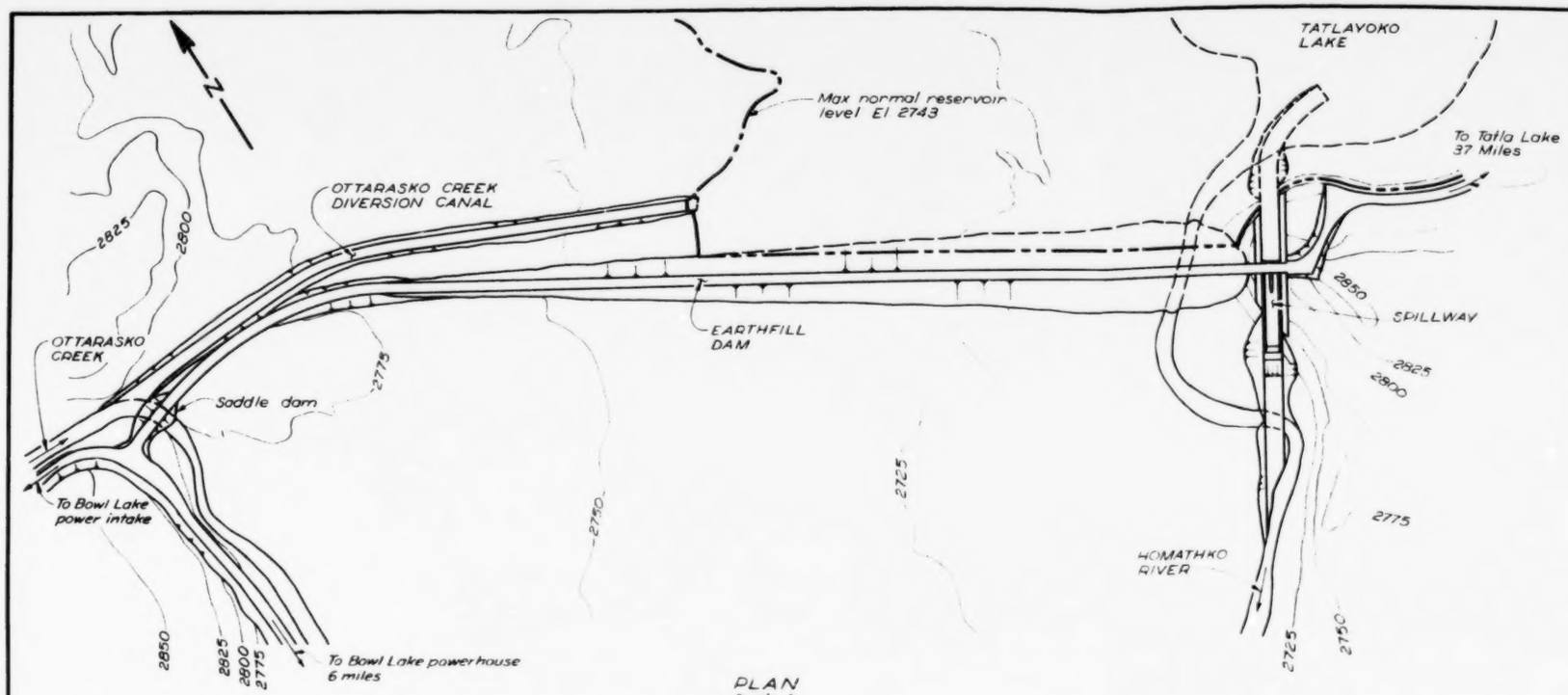
1. NORMAL MAXIMUM RESERVOIR ELEVATIONS ARE SHOWN.

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

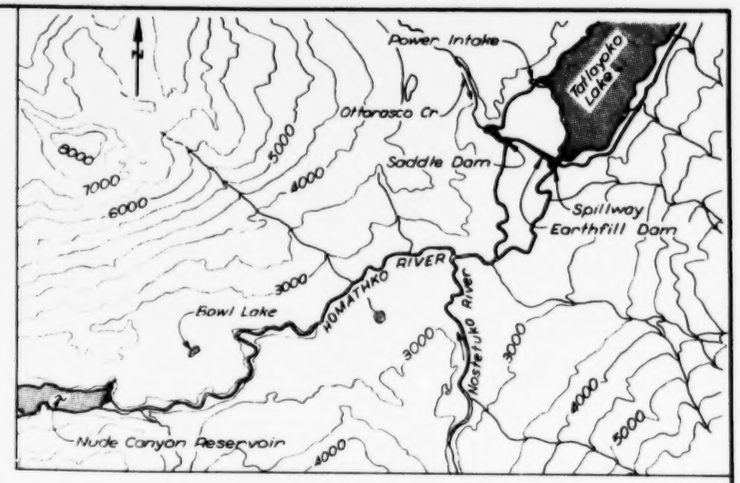
HOMATHKO DEVELOPMENT OVERVIEW STUDY

RIVER PROFILES SHOWING THE SCHEME OF DEVELOPMENT

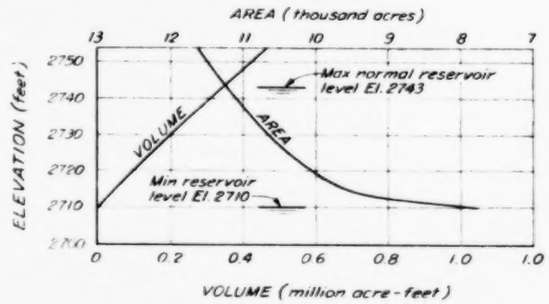
DATE JUN 1981	PLATE 3-2	R
DWN D.A.J.	DWG No. 704 - C14 - D3	



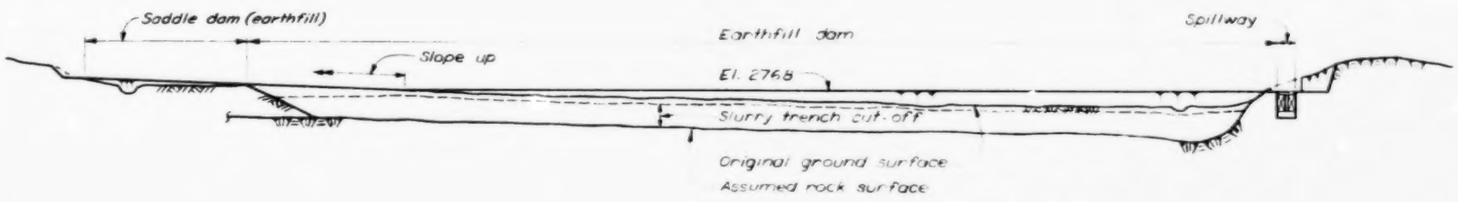
PLAN
Scale A



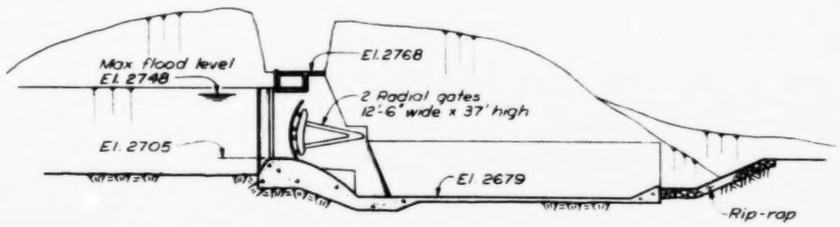
LOCATION PLAN
Scale C



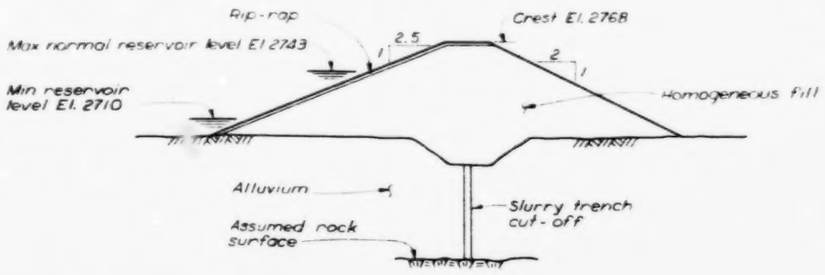
RESERVOIR AREA & VOLUME CURVES



DEVELOPED DOWNSTREAM ELEVATION
Scale A



SECTION THROUGH SPILLWAY HEADWORKS
Scale B



SECTION THROUGH EARTHFILL DAM
Scale B

NOTES:

CONSTRUCTION OF THE PROJECT FACILITIES WOULD BE COMPLETED WITHIN 2-1/2 YEARS AFTER AWARD OF FIRST CONTRACT AND 3 YEARS AFTER PROJECT APPROVAL.

Scale C 1 0 1 2 Miles

Scale: B 50 0 50 100 150 Feet

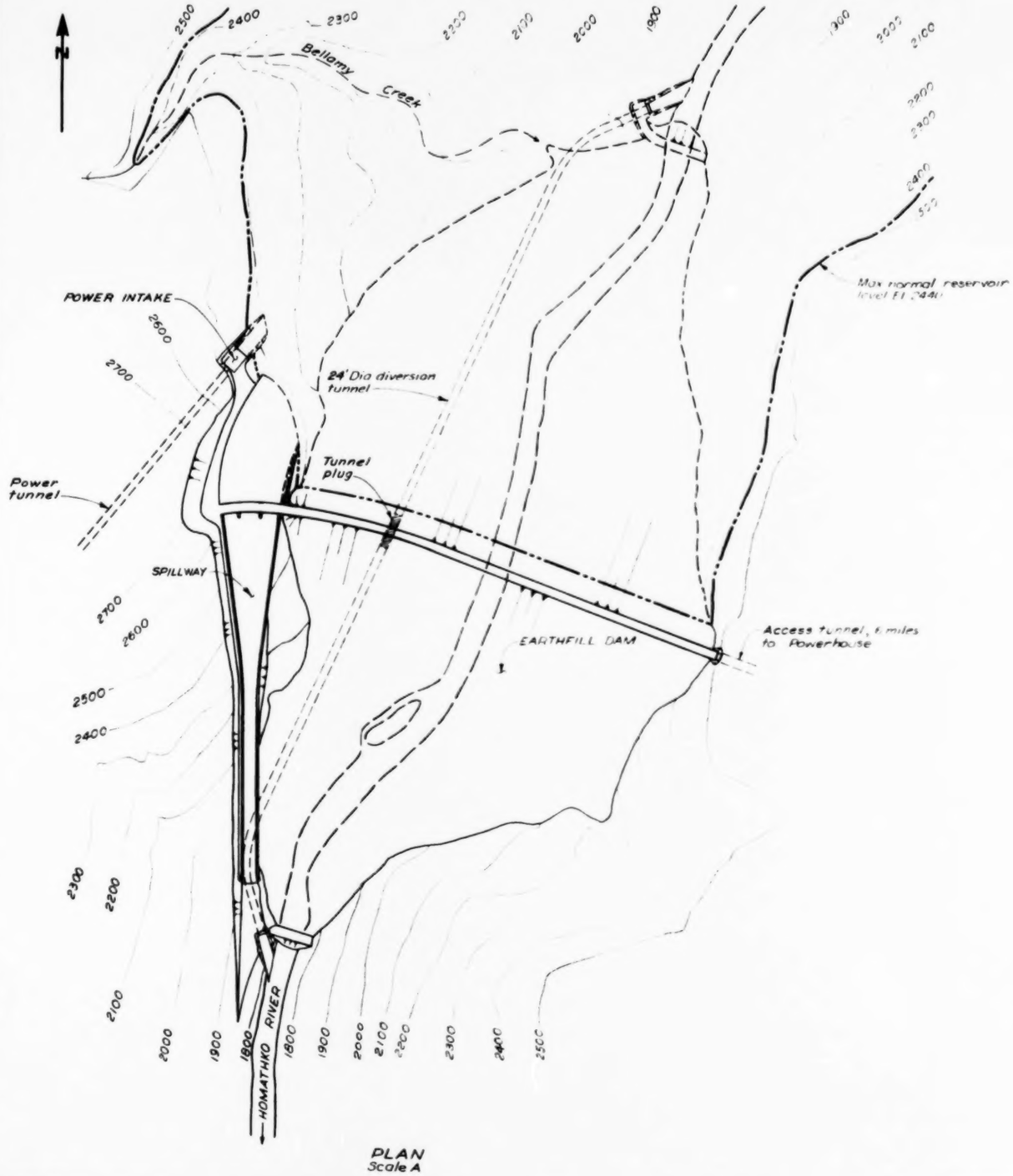
Scale: A 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

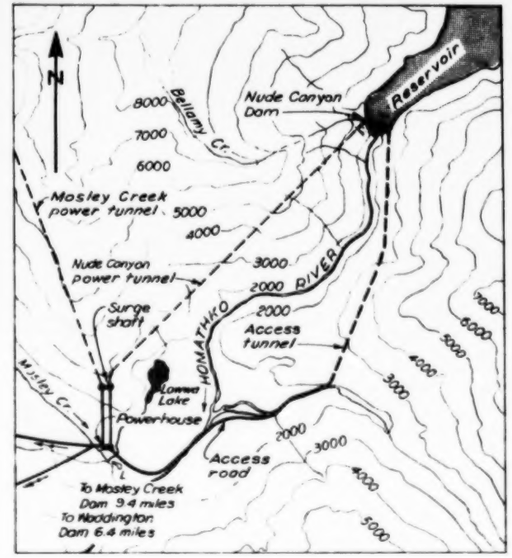
HOMATHKO DEVELOPMENT OVERVIEW STUDY

TATLAYOKO STORAGE PROJECT GENERAL ARRANGEMENT ELEVATION AND SECTIONS

DATE	PLATE	
JUN 1981	7-1	R
DWN D.S.	DWG No. 704 - C14 - D5	



PLAN
Scale A



LOCATION PLAN
Scale B

ITEM	CALENDER YEARS TO FIRST IN-SERVICE										
				0	1	2	3	4	5	6	7
ENGINEERING & ENVIRONMENTAL INVESTIGATIONS & ASSESSMENT				PROJECT APPROVAL							
FIRST CONTRACT AWARD				▲							
FINAL DESIGN											
ACCESS											
RESERVOIR						BEGIN DIVERSION					
DIVISION WORK											
EARTHFILL DAM											
SPILLWAY											
POWER INTAKE											
POWER TUNNEL											
POWER CONDUITS											
POWERPLANT											

PLANNING, DESIGN AND CONSTRUCTION SCHEDULE

Scale: B 1 0 1 2 Miles

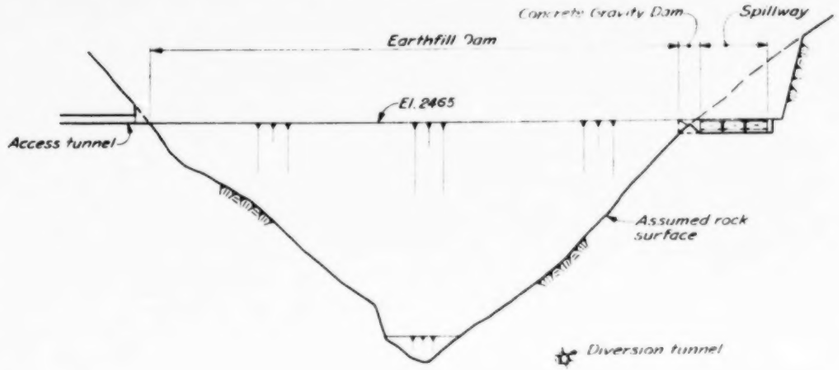
Scale: A 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

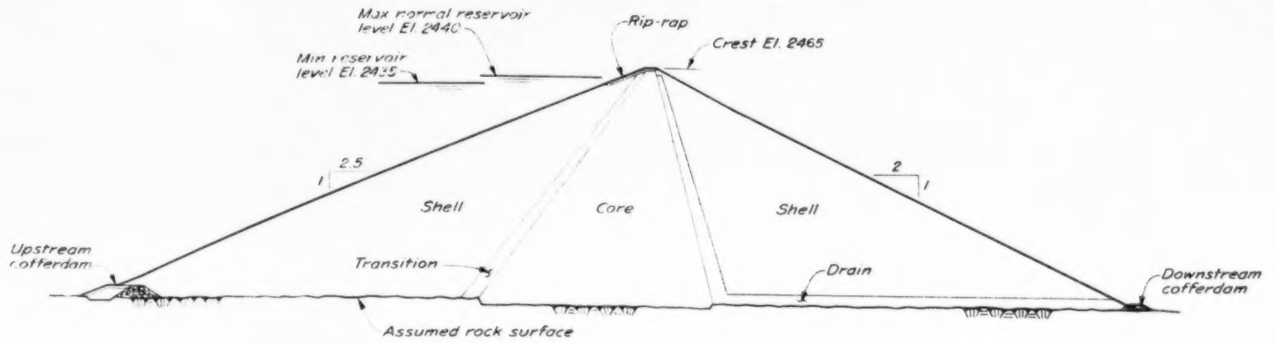
HOMATHKO DEVELOPMENT OVERVIEW STUDY

NUDE CANYON PROJECT GENERAL ARRANGEMENT

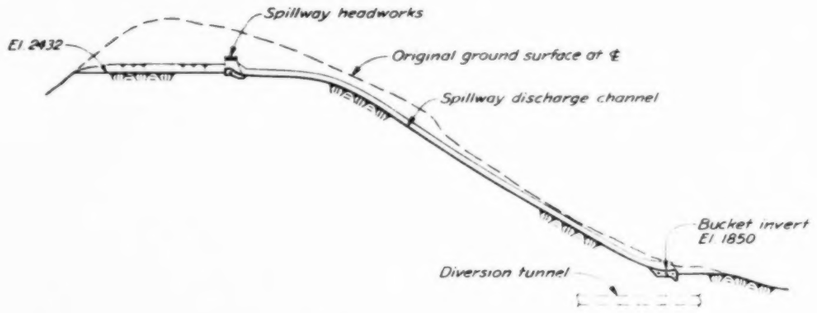
DATE JUN 1981	PLATE 8-1	R
DWN C.Y.	DWG No. 704 - C14 - D6	



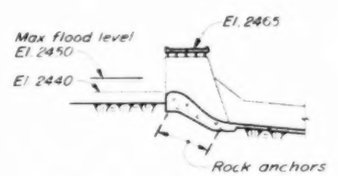
DEVELOPED UPSTREAM ELEVATION
Scale A



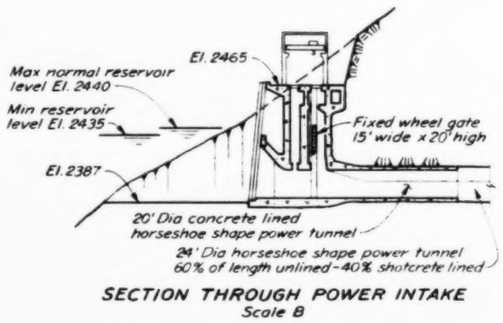
SECTION THROUGH EARTHFILL DAM
Scale A



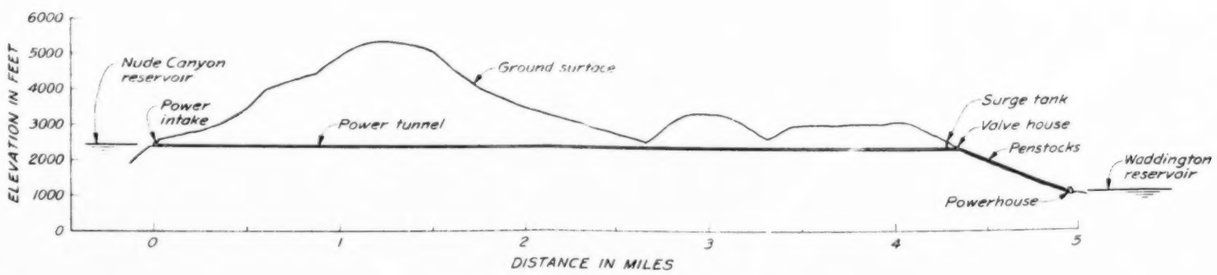
SECTION THROUGH SPILLWAY
Scale A



SECTION THROUGH SPILLWAY HEADWORKS
Scale B


El. 2465
Max normal reservoir level El. 2440
Min reservoir level El. 2435
Fixed wheel gate 15' wide x 20' high
El. 2387
20' Dia concrete lined horseshoe shape power tunnel
24' Dia horseshoe shape power tunnel 60% of length unlined - 40% shotcrete lined

SECTION THROUGH POWER INTAKE
Scale B



SECTION ALONG ℄ POWER WORKS

Scale: B 50 0 50 100 150 Feet

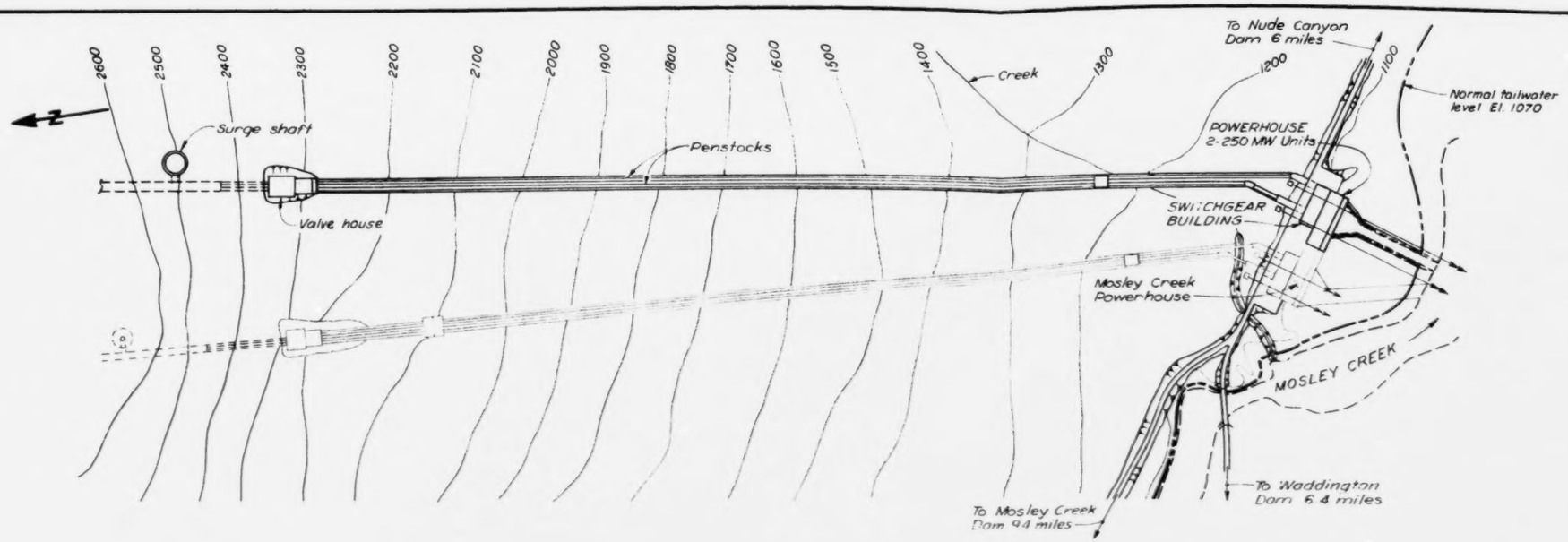
Scale: A 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

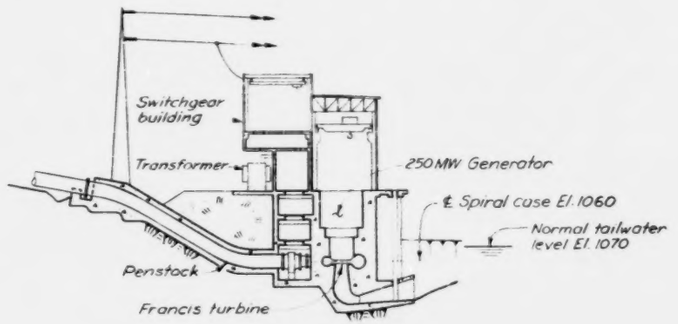
HOMATHKO DEVELOPMENT OVERVIEW STUDY

NUDE CANYON PROJECT
ELEVATION AND SECTIONS

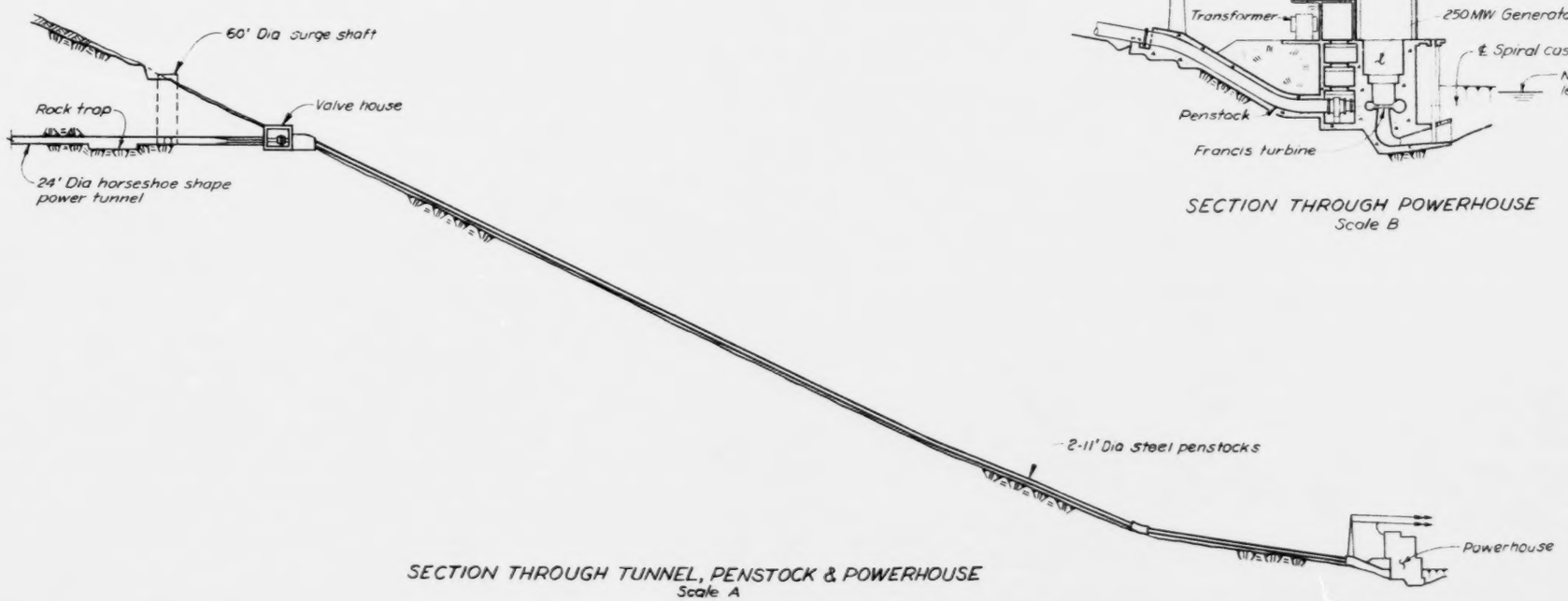
DATE	JUN 1981	PLATE 8-2	R
DWN	AV	DWG No.	704 - C14 - D7



PLAN
Scale A



SECTION THROUGH POWERHOUSE
Scale B



SECTION THROUGH TUNNEL, PENSTOCK & POWERHOUSE
Scale A

Scale: B 50 0 50 100 150 Feet

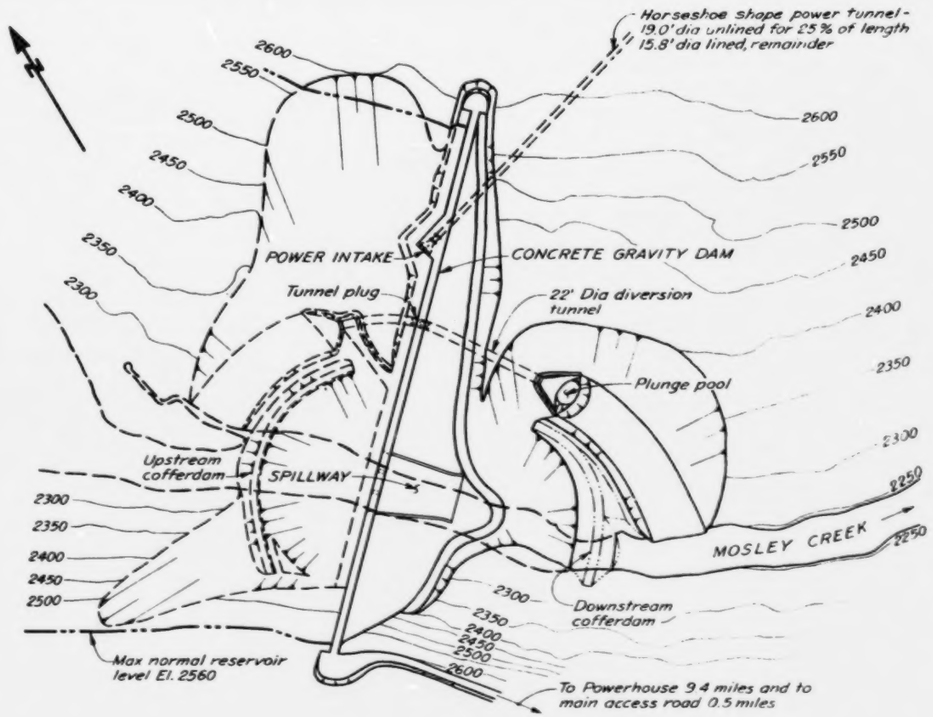
Scale: A 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

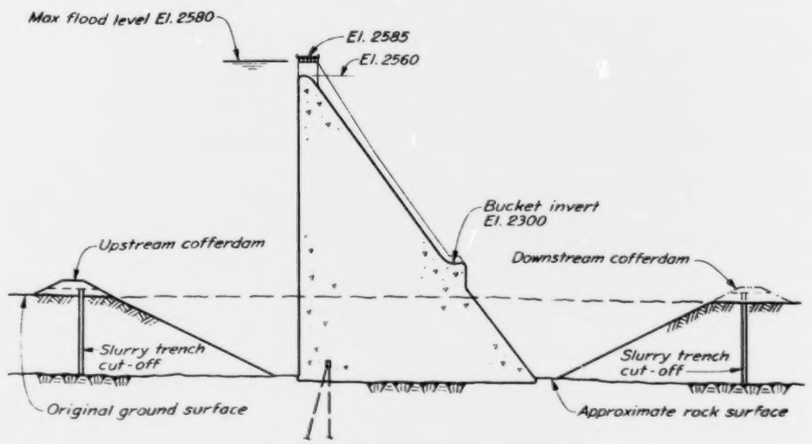
HOMATHKO DEVELOPMENT OVERVIEW STUDY

NUDE CANYON PROJECT
POWER FACILITIES
PLAN AND SECTIONS

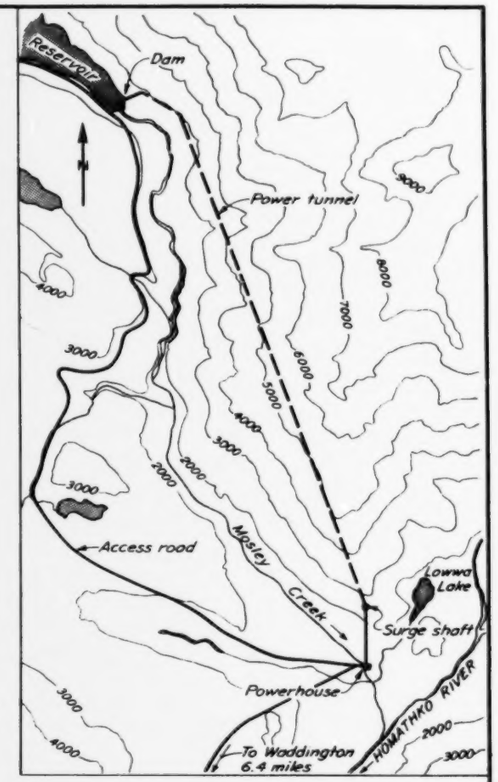
DATE JUN 1981	PLATE 8-3	R
DWN C.Y.	DWG No. 704-C14-D8	


Horseshoe shape power tunnel - 19.0' dia unlined for 25% of length 15.8' dia lined, remainder
POWER INTAKE
CONCRETE GRAVITY DAM
Tunnel plug
22' Dia diversion tunnel
Plunge pool
Upstream cofferdam
SPILLWAY
MOSLEY CREEK
Downstream cofferdam
Max normal reservoir level El. 2560
To Powerhouse 9.4 miles and to main access road 0.5 miles

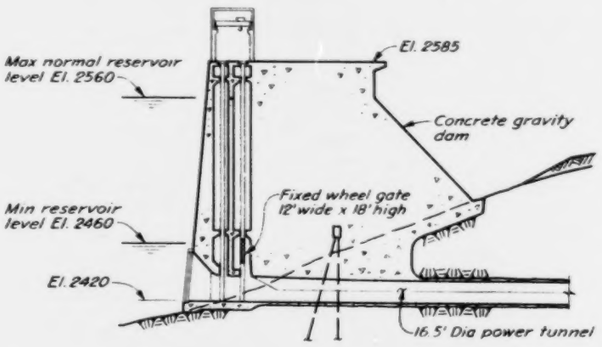
PLAN
Scale A



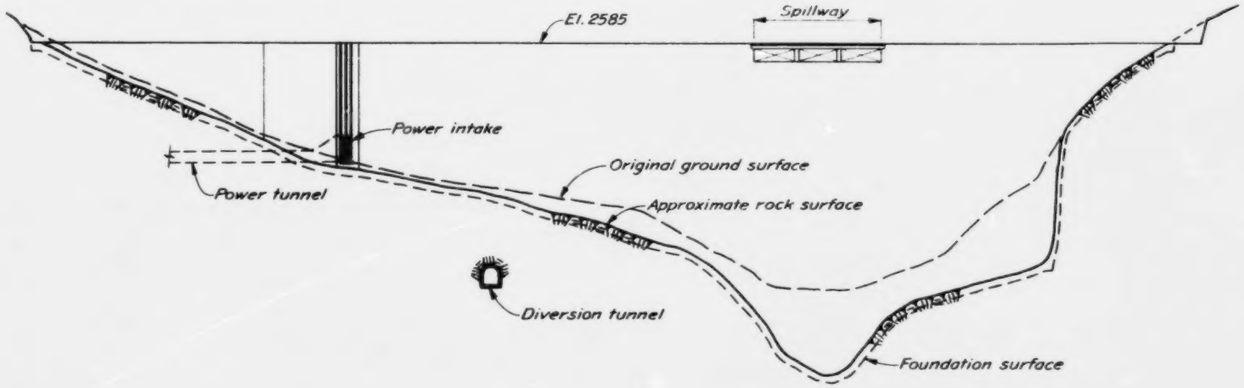
SECTION THROUGH SPILLWAY
Scale B



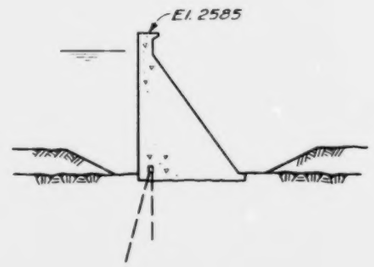
LOCATION PLAN
Scale D


Max normal reservoir level El. 2560
El. 2585
Concrete gravity dam
Min reservoir level El. 2460
Fixed wheel gate 12' wide x 18' high
El. 2420
16.5' Dia power tunnel

SECTION THROUGH POWER INTAKE
Scale C



DEVELOPED UPSTREAM ELEVATION
Scale B



SECTION THROUGH CONCRETE GRAVITY DAM
Scale B

Scale: D 1 0 1 2 Miles

Scale: C 50 0 50 100 150 Feet

Scale: B 100 0 100 200 300 Feet

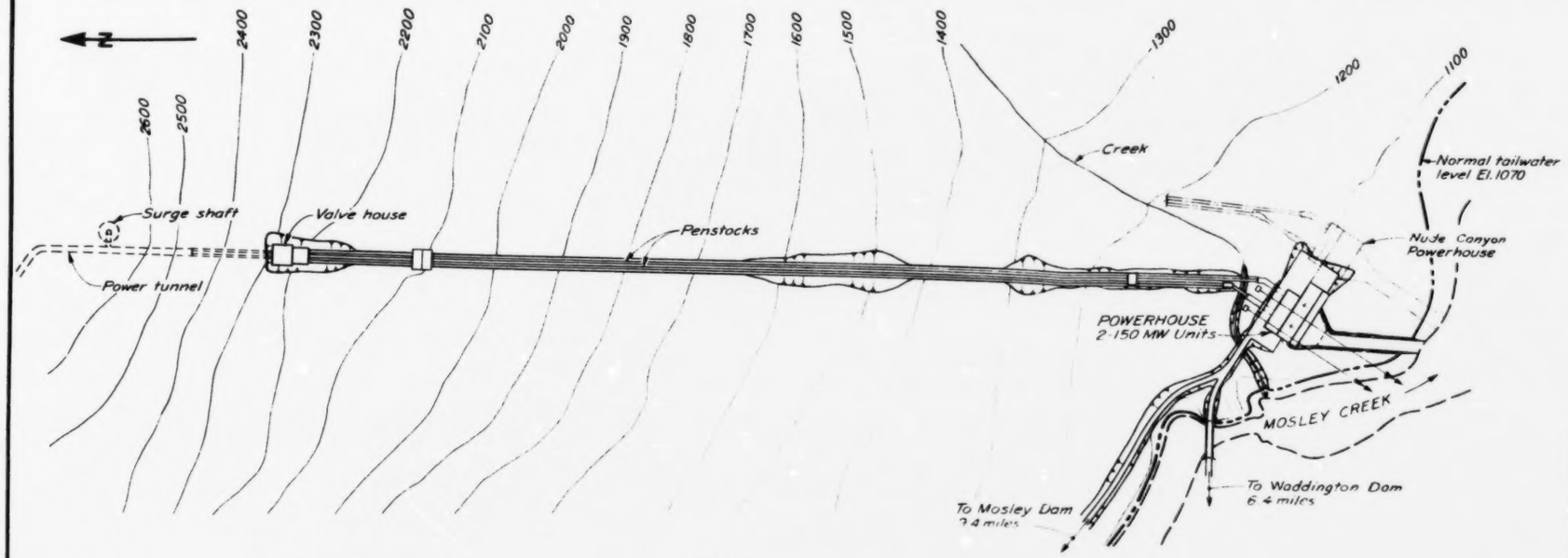
Scale: A 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

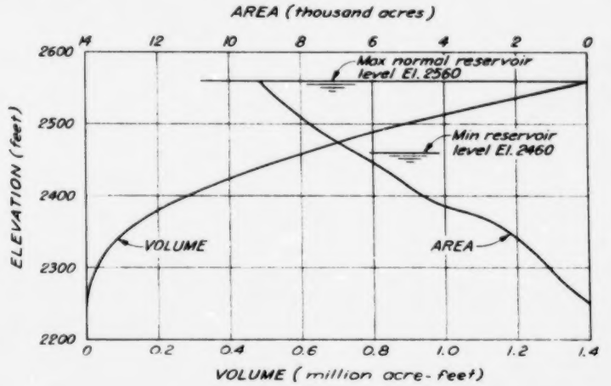
HOMATHKO DEVELOPMENT OVERVIEW STUDY

MOSLEY CREEK PROJECT
GENERAL ARRANGEMENT
ELEVATION AND SECTIONS

DATE		
JUN 1981	PLATE 9-1	R
DWN AV	DWG No. 704-C14-D9	



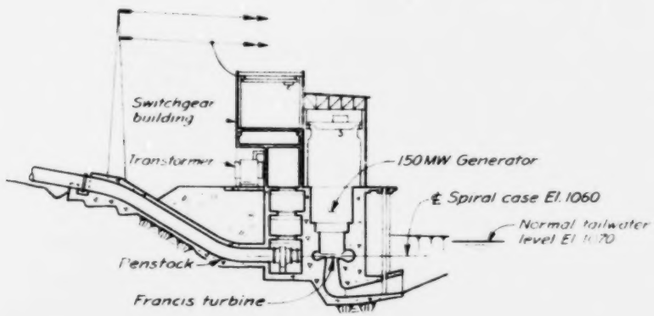
PLAN
Scale A



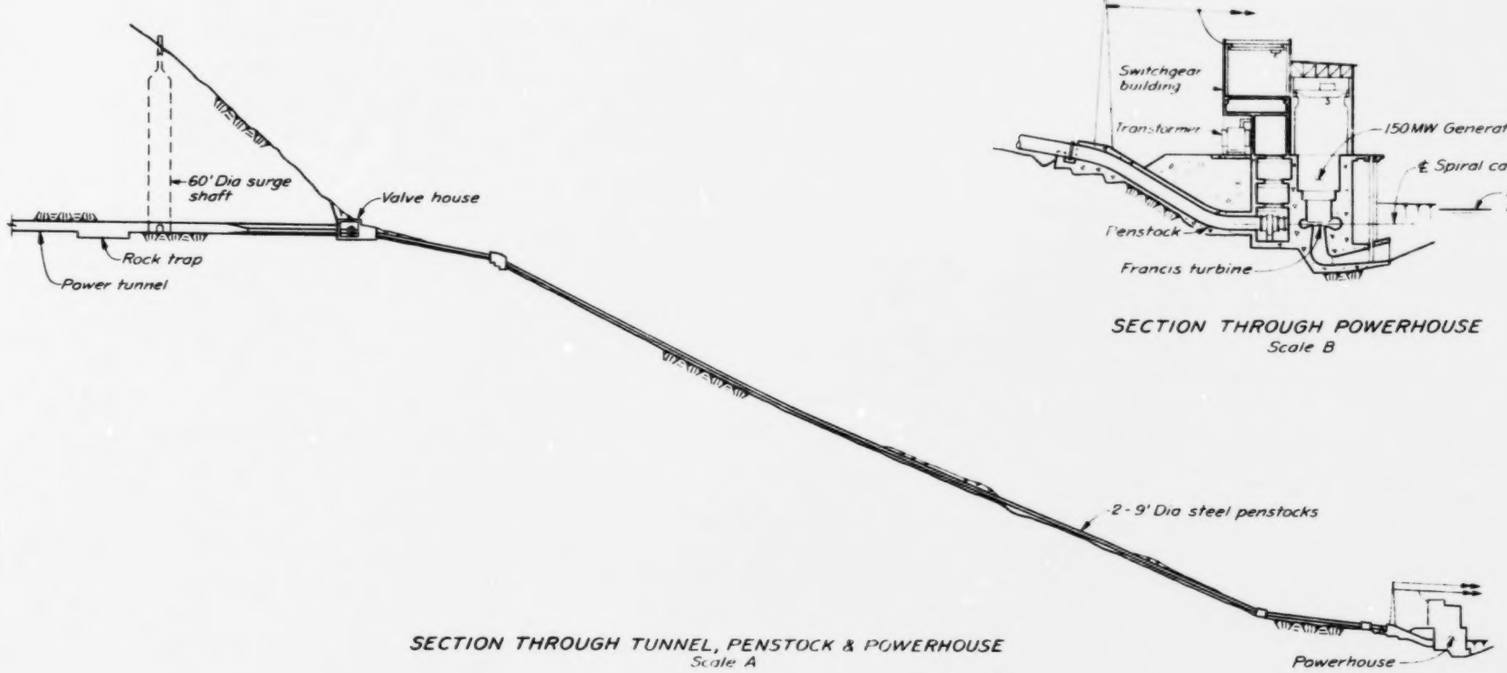
RESERVOIR AREA & VOLUME CURVES

ITEM	CALENDAR YEARS TO FIRST IN-SERVICE										
					1	2	3	4	5	6	
ENGINEERING & ENVIRONMENTAL INVESTIGATIONS & ASSESSMENT					PROJECT APPROVAL						UNITS IN SERVICE
[illegible] IMPACT A.											
FINAL DESIGN											
ACCESS											
RESERVOIR									TUNNEL CLOSURE		
DIVERSION WORKS											
CONCRETE GRAVITY DAM					BEGIN DIVERSION						
SPILLWAY											
POWER INTAKE											
POWER TUNNEL											
PENSTOCKS											
POWERPLANT											

PLANNING, DESIGN AND CONSTRUCTION SCHEDULE



SECTION THROUGH POWERHOUSE
Scale B



SECTION THROUGH TUNNEL, PENSTOCK & POWERHOUSE
Scale A

Scale: B 50 0 50 100 150 Feet

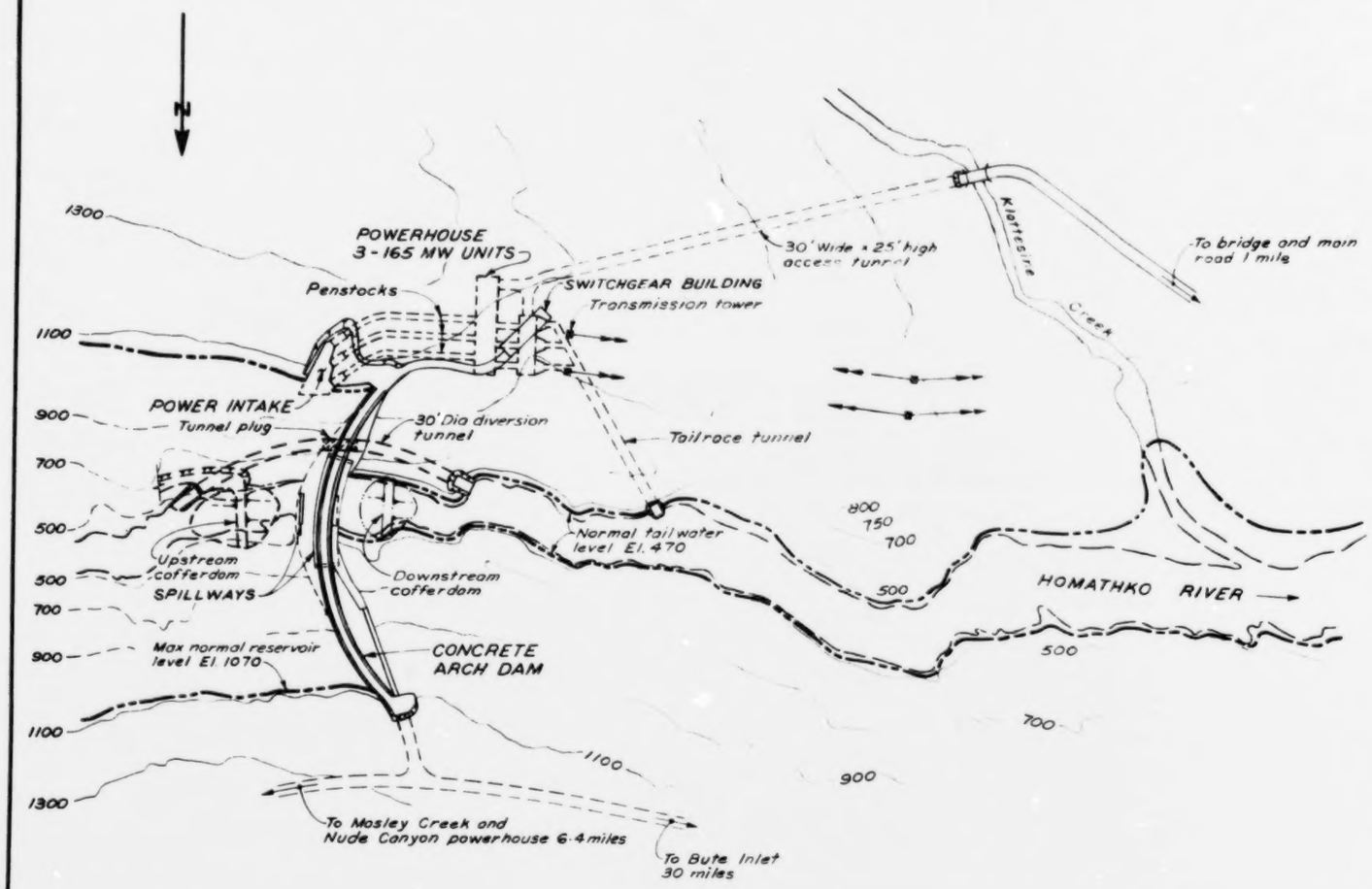
Scale: A 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HOMATHKO DEVELOPMENT OVERVIEW STUDY
MOSLEY CREEK PROJECT
POWER FACILITIES
PLAN AND SECTIONS

DATE	JUN 1981	PLATE 9-2	R
DWN	AV	DWG No.	704-C14-D10

REPRINT [illegible] 1978



PLAN

ITEM	CALENDER YEARS TO FIRST IN-SERVICE										
				0	1	2	3	4	5	6	7	8
ENGINEERING & ENVIRONMENTAL INVESTIGATIONS & ASSESSMENT					PROJECT APPROVAL							
FIRST CONTRACT AWRD				△								
FINAL DESIGN												
ACCESS												
RESERVOIR					BEGIN DIVERSION							
DIVERSION WORKS												
ARCH DAM & SPILLWAY												
POWER INTAKES												
POWER CONDUITS												
POWERPLANT												

UNIT 1 & 2 IN SERVICE

UNIT 3 IN SERVICE

PLANNING, DESIGN AND CONSTRUCTION SCHEDULE

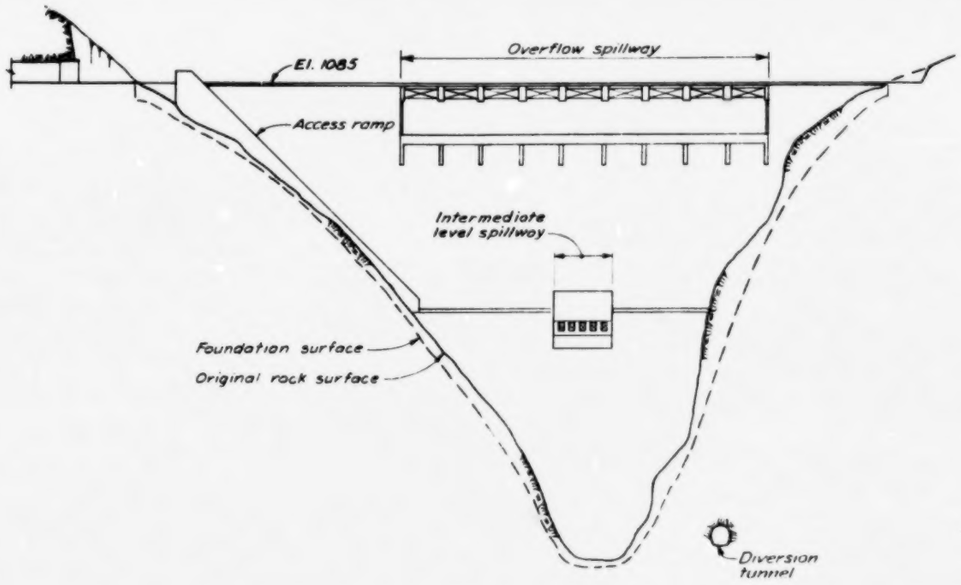
Scale: 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

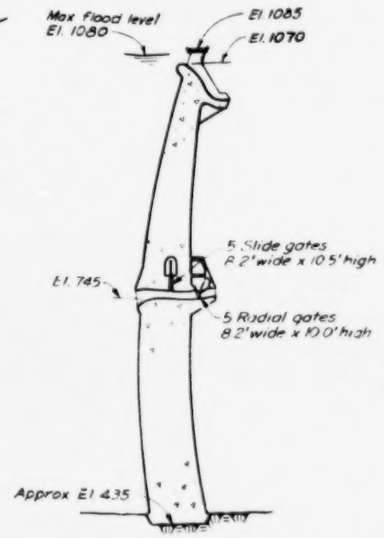
HOMATHKO DEVELOPMENT OVERVIEW STUDY

WADDINGTON PROJECT GENERAL ARRANGEMENT

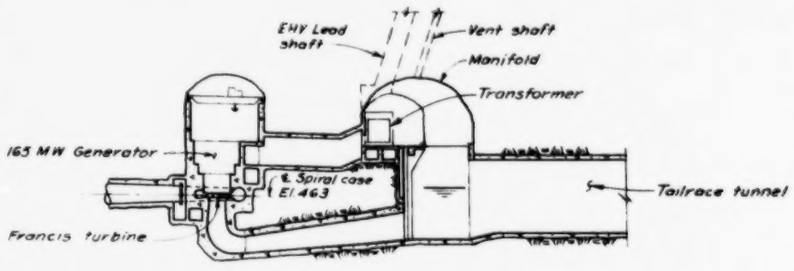
DATE	PLATE 10-1	R
JUN 1981		
DWN D. J.	DWG No. 704 - C14 - D11	



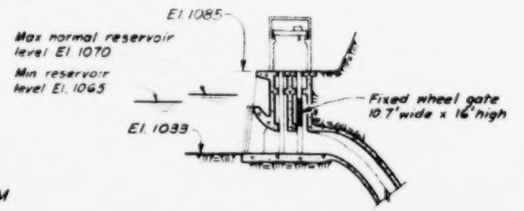
DEVELOPED DOWNSTREAM ELEVATION
Scale A



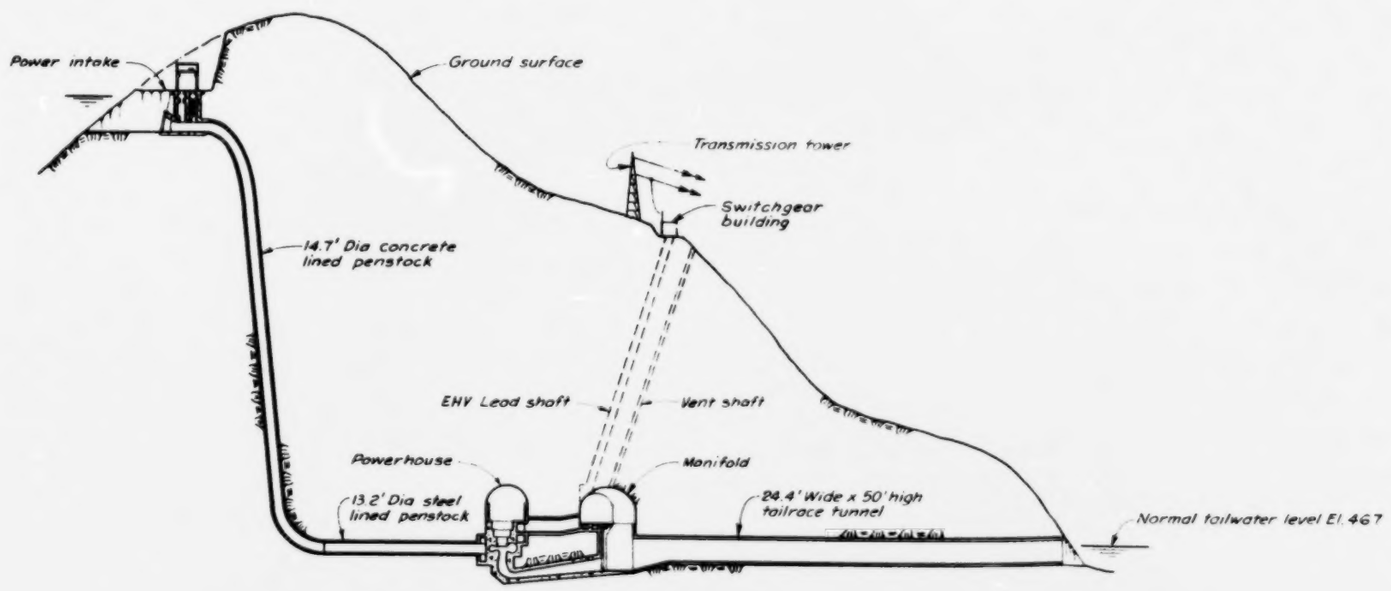
SECTION THROUGH CONCRETE ARCH DAM
Scale A



SECTION THROUGH POWERHOUSE
Scale B



SECTION THROUGH POWER INTAKE
Scale B



SECTION THROUGH INTAKE, PENSTOCK & POWERHOUSE
Scale A

Scale: B 50 0 50 100 150 Feet

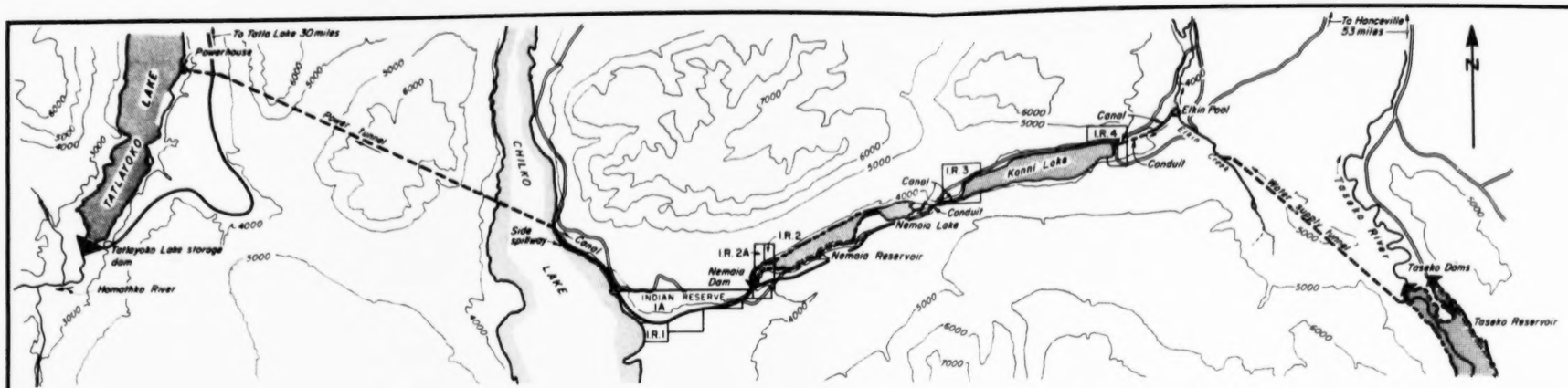
Scale: A 100 0 100 200 300 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

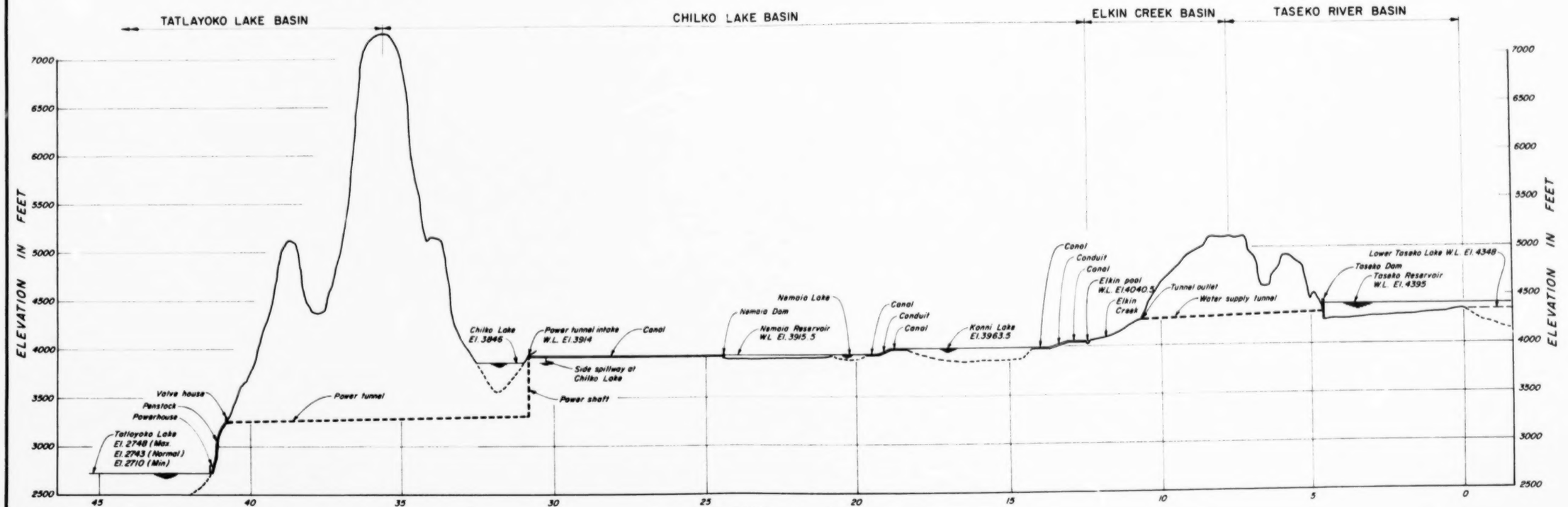
HOMATHKO DEVELOPMENT OVERVIEW STUDY

WADDINGTON PROJECT ELEVATION AND SECTIONS

DATE	PLATE 10-2	R
JUN 1981		
DWN G.C.	DWG No. 704-C14-D12	



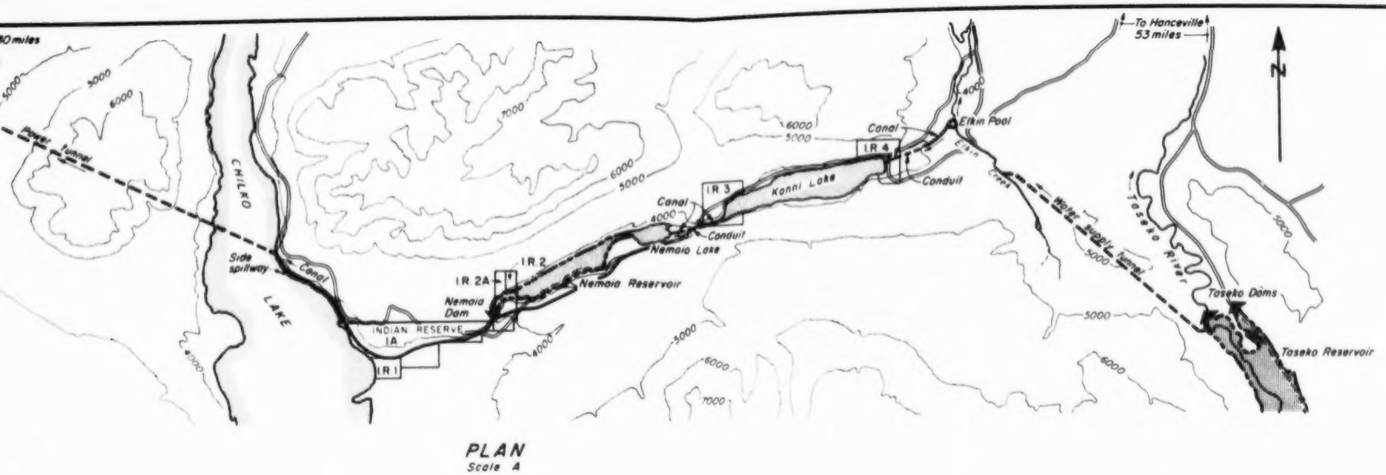
PLAN
Scale A



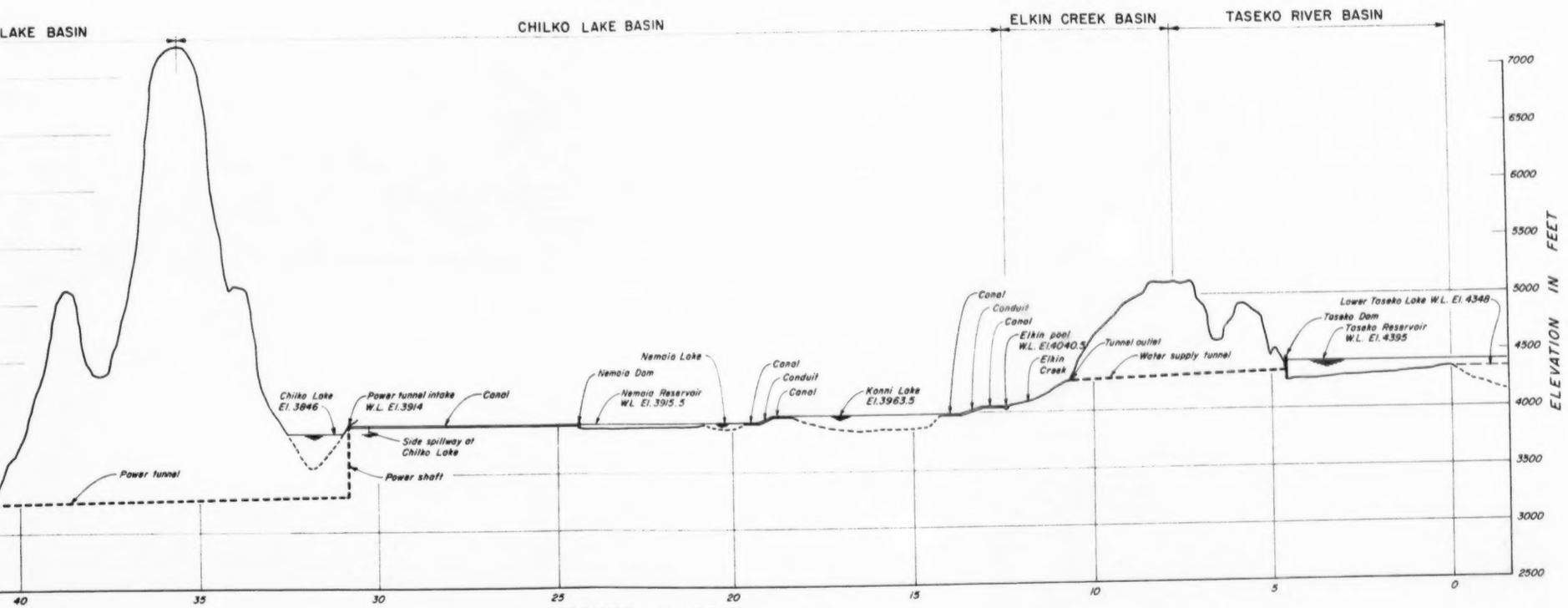
PROFILE

Scale A 2 0

BRITISH COLUM
HOMATHKO DEVELOP
TASEKO – TAT
GENERAL ARR
PLAN AND PR
DATE JUN 1981
DWN A. H.



PLAN
Scale A



PROFILE

LEGEND:

- DAM
- POWERHOUSE
- RESERVOIR
- POWER TUNNEL
- EXISTING ROAD
- PROPOSED ACCESS ROAD

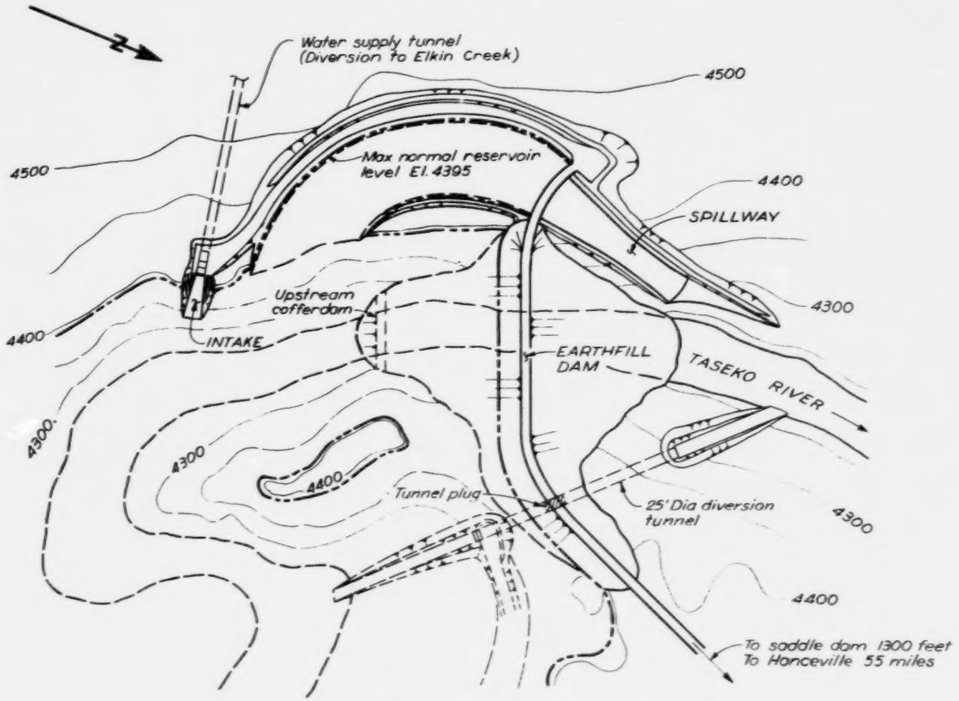
Scale A 2 0 2 4 6 Miles

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

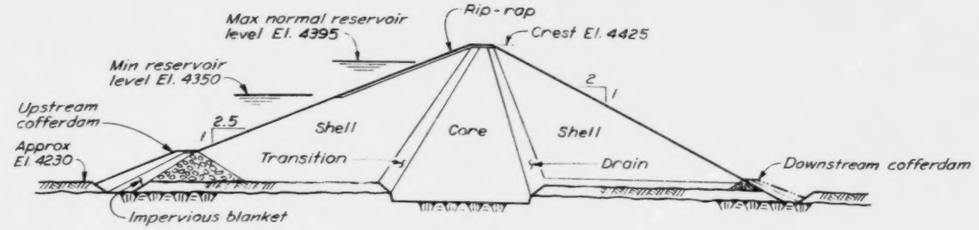
HOMATHKO DEVELOPMENT OVERVIEW STUDY

TASEKO - TATLAYOKO DIVERSION GENERAL ARRANGEMENT PLAN AND PROFILE

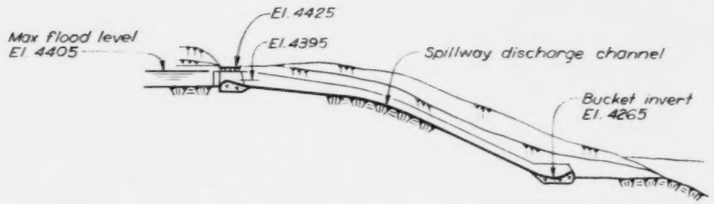
DATE JUN 1981	PLATE 11-1	R
DWN A. H.	DWG No. 704 - C14 - U13	



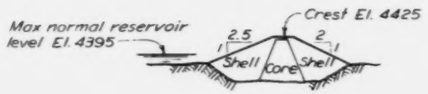
PLAN
Scale A



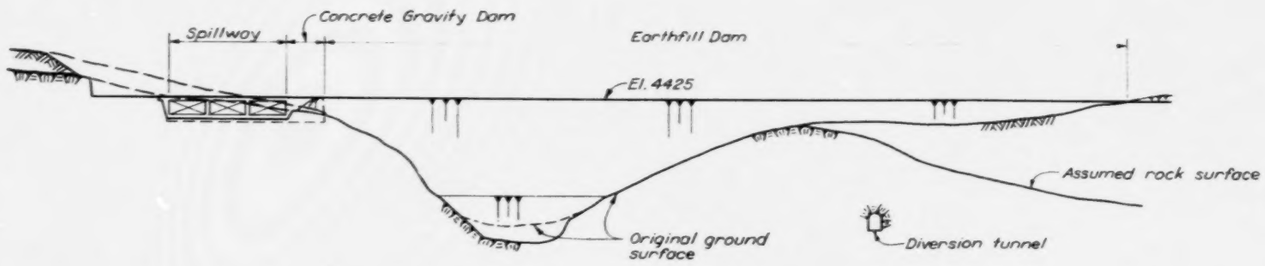
SECTION THROUGH EARTHFILL DAM
Scale B



SECTION THROUGH SPILLWAY
Scale B

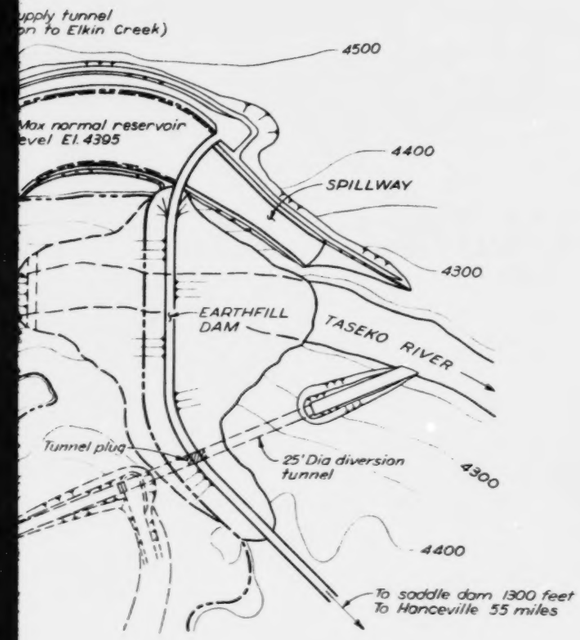


SECTION THROUGH SADDLE DAM
Scale B

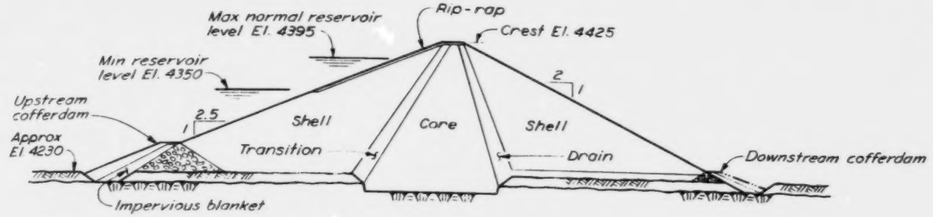


DEVELOPED UPSTREAM ELEVATION
Scale B

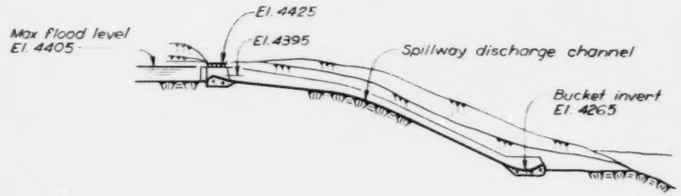
ELEVATION (feet)
4500
4480
4460
4440
4420
4400
4380
4360
4340
4320
4300



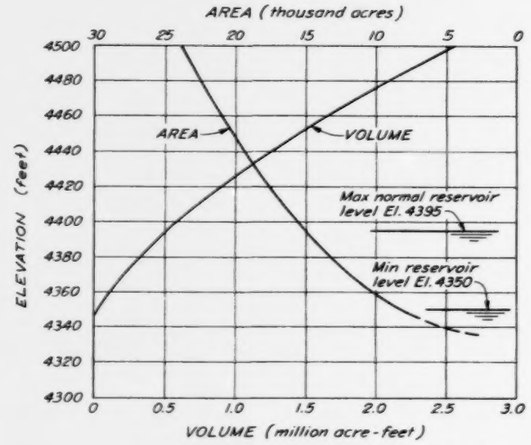
PLAN
Scale A



SECTION THROUGH EARTHFILL DAM
Scale B

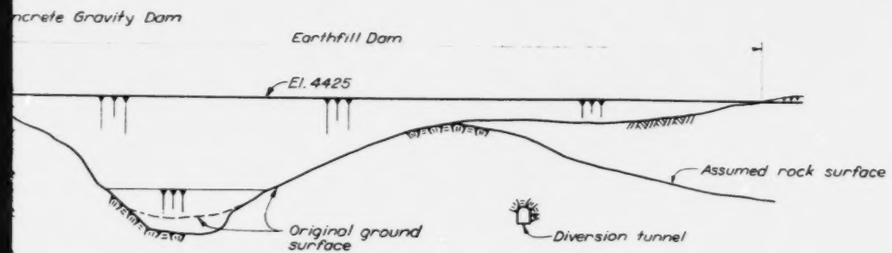


SECTION THROUGH SPILLWAY
Scale B



RESERVOIR AREA & VOLUME CURVES

SECTION THROUGH SADDLE DAM
Scale B



DEVELOPED UPSTREAM ELEVATION
Scale B

Scale: B 100 0 100 200 300 Feet

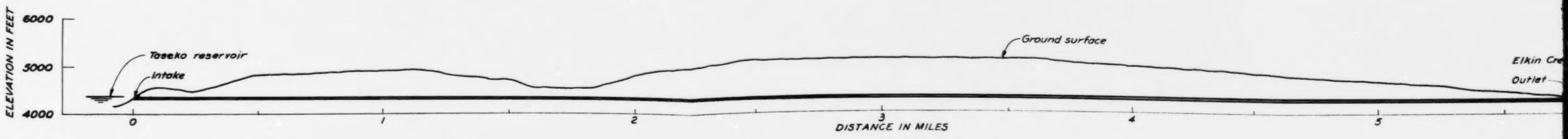
Scale: A 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

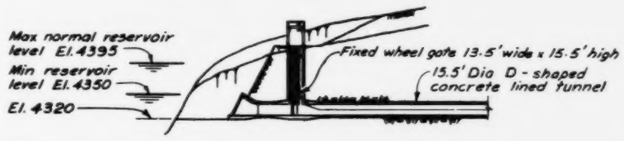
HOMATHKO DEVELOPMENT OVERVIEW STUDY

TASEKO - TATLAYOKO DIVERSION
TASEKO DAM
PLAN, ELEVATION AND SECTIONS

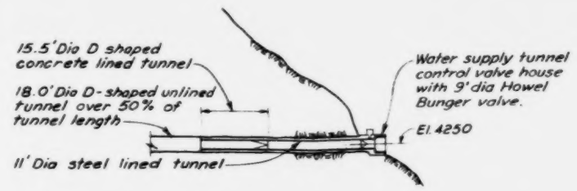
DATE JUN 1981	PLATE 11-2	R
DWN CY/DS	DWG No. 704 - C14 - U14	



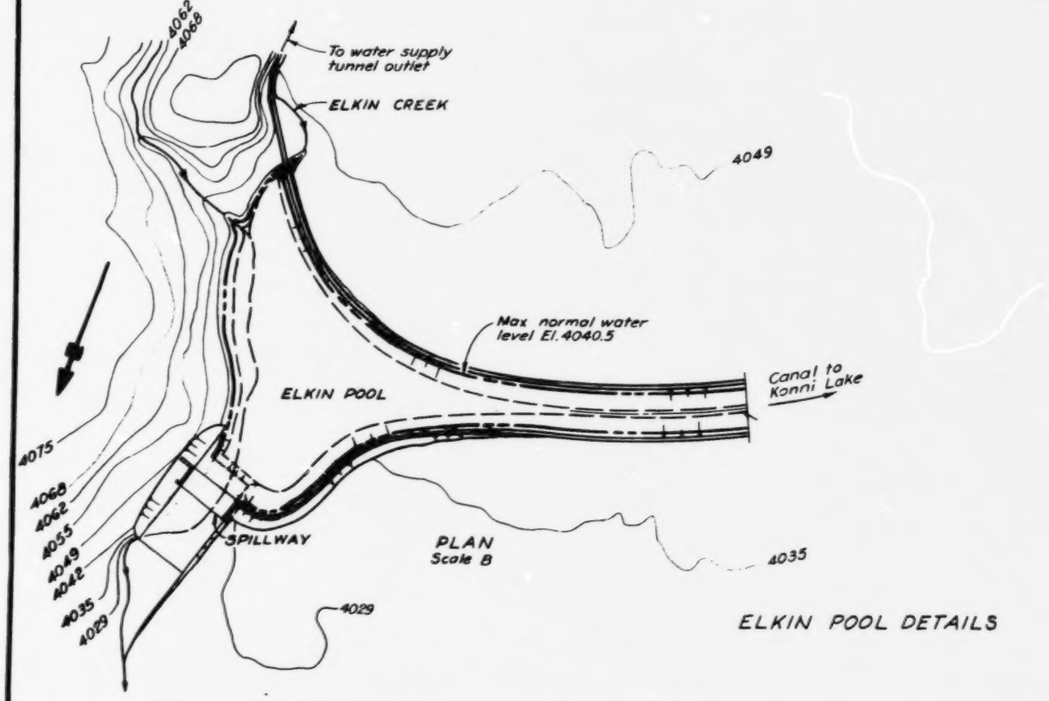
PROFILE ALONG WATER SUPPLY TUNNEL

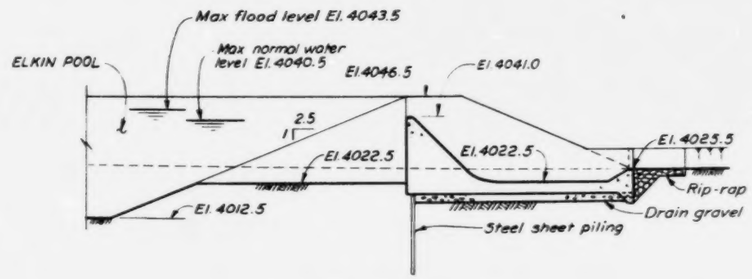

Max normal reservoir level El. 4395
Min reservoir level El. 4350
El. 4320
Fixed wheel gate 13.5' wide x 15.5' high
15.5' Dia D - shaped concrete lined tunnel

SECTION THROUGH INTAKE
Scale A


15.5' Dia D shaped concrete lined tunnel
18.0' Dia D-shaped unlined tunnel over 50% of tunnel length
11' Dia steel lined tunnel
Water supply tunnel control valve house with 9' dia Howel Bunger valve.
El. 4250

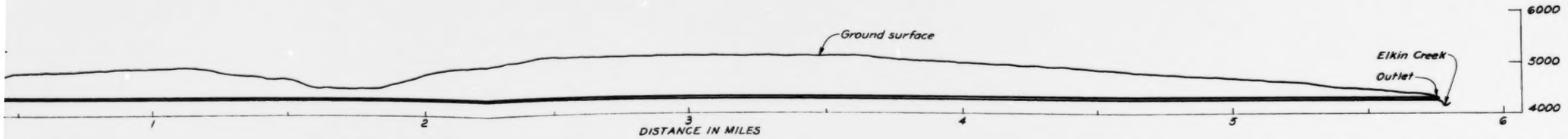
SECTION THROUGH OUTLET
Scale A



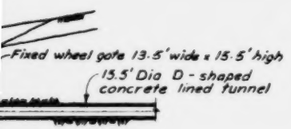


SECTION THROUGH SPILLWAY
Scale C

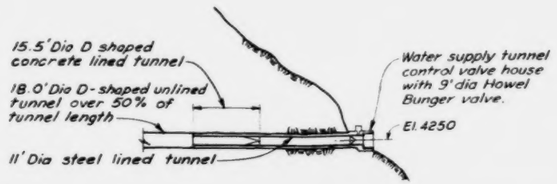
ELKIN POOL DETAILS



PROFILE ALONG WATER SUPPLY TUNNEL



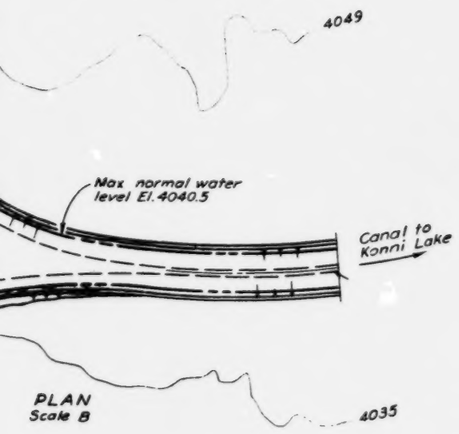
THROUGH INTAKE
Scale A


15.5' Dia D shaped concrete lined tunnel
18.0' Dia D-shaped unlined tunnel over 50% of tunnel length
11' Dia steel lined tunnel
Water supply tunnel control valve house with 9' dia Howel Bunger valve.
El. 4250

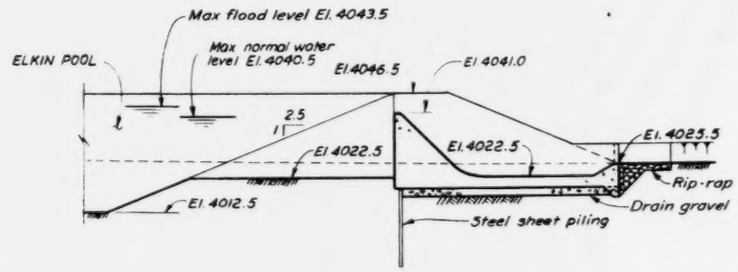
SECTION THROUGH OUTLET
Scale A

supply
tlet

REEK



PLAN
Scale B



SECTION THROUGH SPILLWAY
Scale C

ELKIN POOL DETAILS

Scale: C 20 0 20 40 60 Feet

Scale: B 200 0 200 400 600 Feet

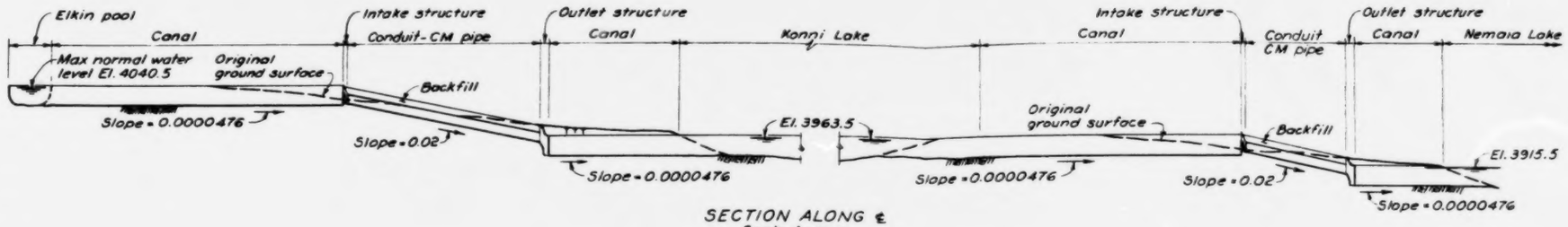
Scale: A 100 0 100 200 300 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

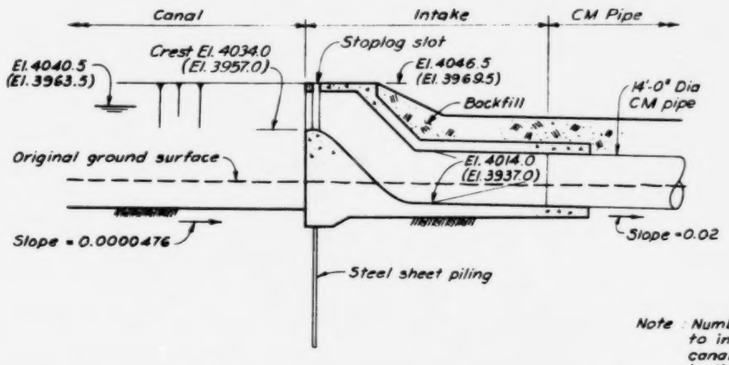
HOMATHKO DEVELOPMENT OVERVIEW STUDY

TASEKO - TATLAYOKO DIVERSION WATER SUPPLY TUNNEL AND ELKIN POOL SECTIONS AND DETAILS

DATE JUN 1981	PLATE 11-3	R
DWN G.C.	DWG No. 704 - C14 - U15	

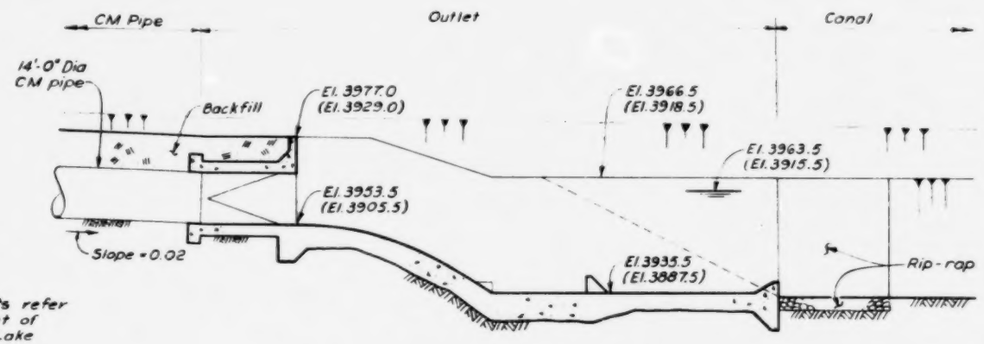


SECTION ALONG ℄
Scale A : Vert
Scale B : Horiz

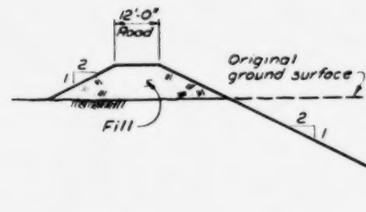


SECTION THROUGH INTAKE
Scale C

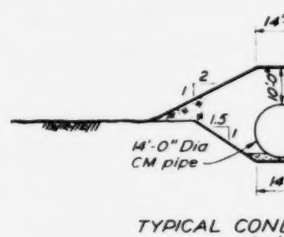
Note : Numbers in brackets refer to intake and outlet of canal from Konni Lake to Nemaia Lake.



SECTION THROUGH OUTLET
Scale C

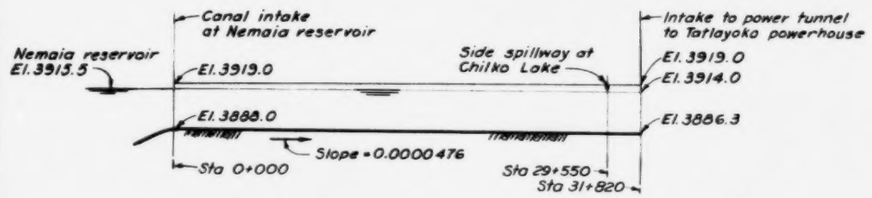


TYPICAL

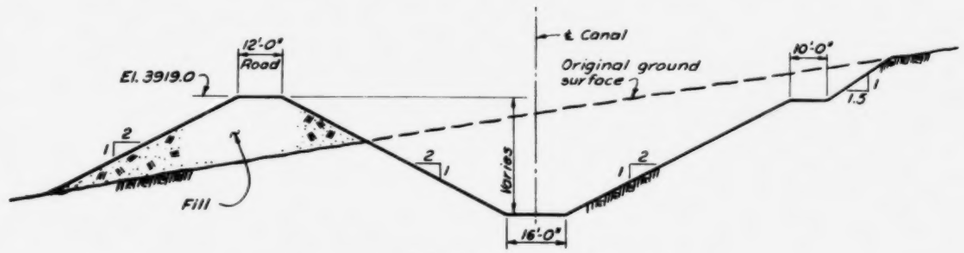


TYPICAL CON
Scale

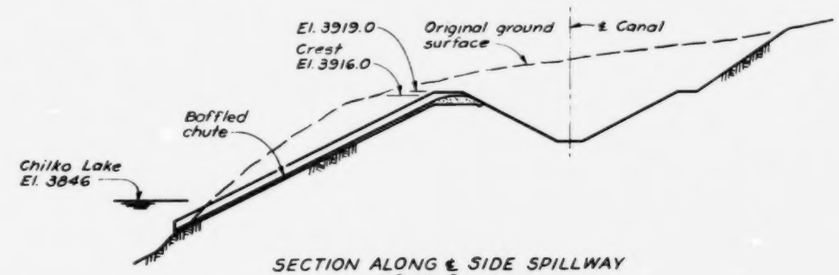
CANALS FROM ELKIN POOL TO KONNI LAKE AND FROM KONNI LAKE TO NEMAIA LAKE



SECTION ALONG ℄ CANAL
Scale D : Vert
Scale E : Horiz

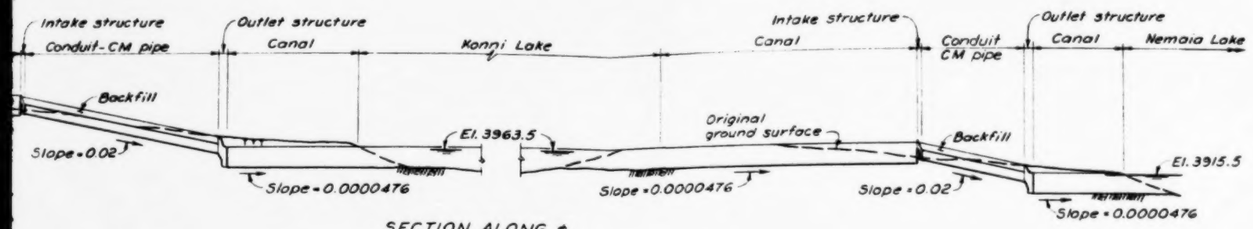


TYPICAL CANAL SECTION
Scale C

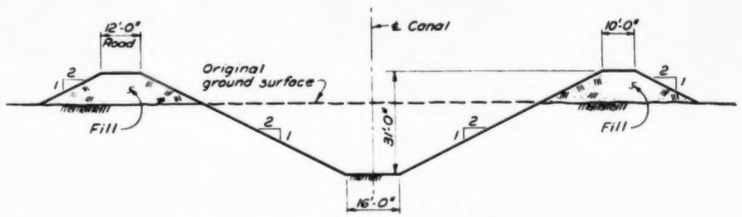


SECTION ALONG ℄ SIDE SPILLWAY
Scale D

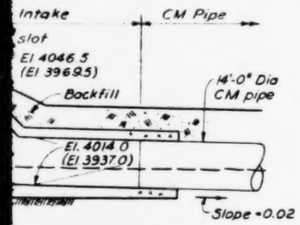
CANAL FROM NEMAIA RESERVOIR TO POWER TUNNEL INTAKE



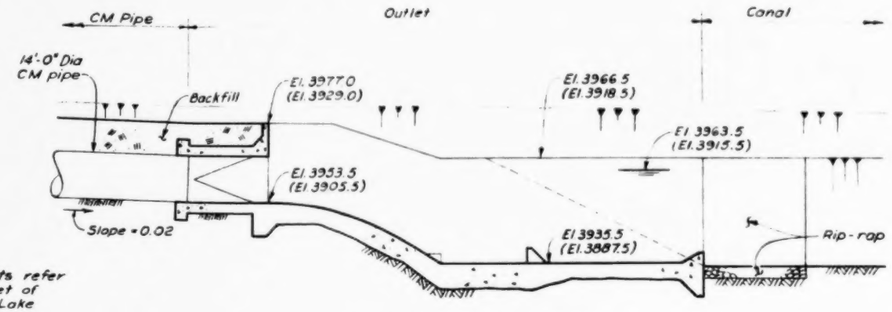
SECTION ALONG ℄
Scale A : Vert
Scale B : Horiz



TYPICAL CANAL SECTION
Scale C

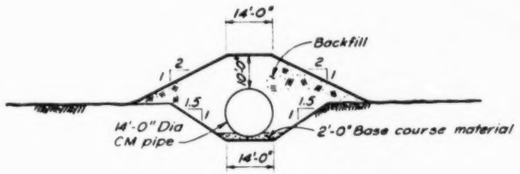


GH INTAKE



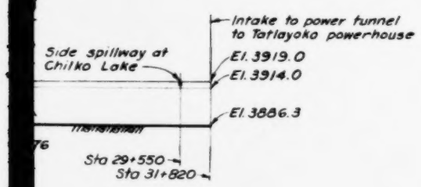
Note : Numbers in brackets refer to intake and outlet of canal from Konni Lake to Nemaia Lake.

SECTION THROUGH OUTLET
Scale C

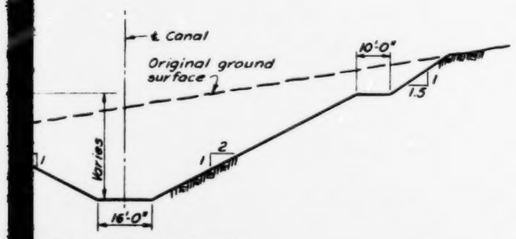


TYPICAL CONDUIT SECTION
Scale C

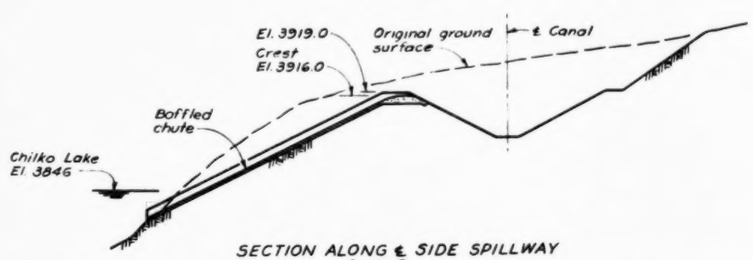
CANALS FROM ELKIN POOL TO KONNI LAKE AND FROM KONNI LAKE TO NEMAIA LAKE



G ℄ CANAL
Vert
Horiz



ICAL CANAL SECTION
Scale C



SECTION ALONG ℄ SIDE SPILLWAY
Scale D

CANAL FROM NEMAIA RESERVOIR TO POWER TUNNEL INTAKE

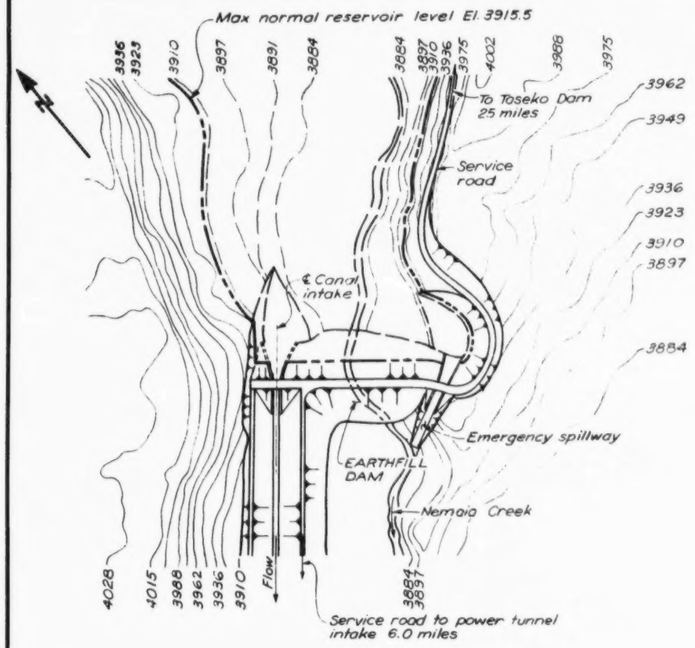
Scale: E 5000 0 5000 10000 15000 Feet
Scale: D 50 0 50 100 150 Feet
Scale: C 20 0 20 40 60 Feet
Scale: B 1000 0 1000 2000 3000 Feet
Scale: A 100 0 100 200 300 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

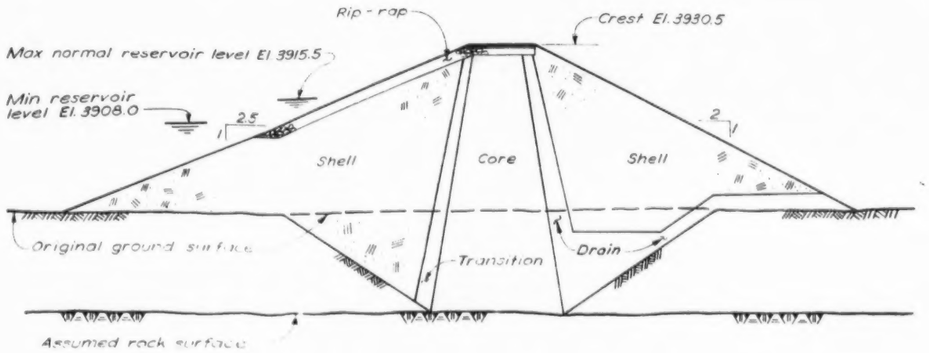
HOMATHKO DEVELOPMENT OVERVIEW STUDY

TASEKO - TATLAYOKO DIVERSION CANALS AND SECTIONS

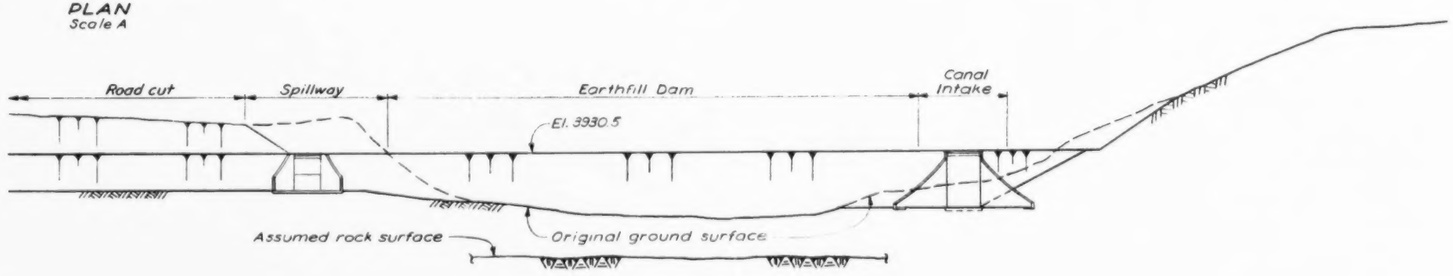
DATE JUN 1981	PLATE 11-4	R
DWN G. C.	DWG No. 704 - C14 - U16	



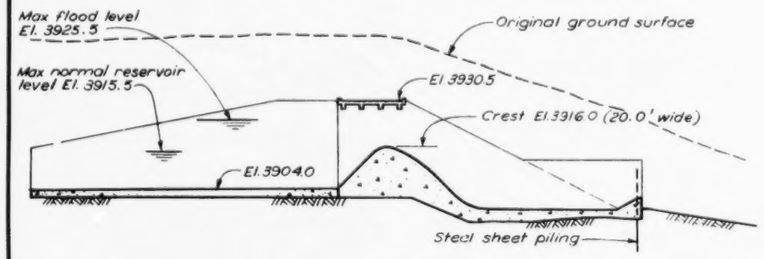
PLAN
Scale A



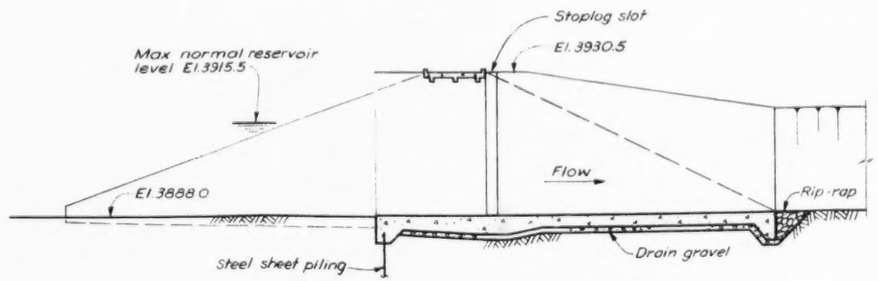
SECTION THROUGH EARTHFILL DAM
Scale B



DEVELOPED UPSTREAM ELEVATION
Scale C



SECTION THROUGH EMERGENCY SPILLWAY
Scale B



SECTION THROUGH CANAL INTAKE
Scale B

Scale: C 50 0 50 100 150 Feet

Scale: B 20 0 20 40 60 Feet

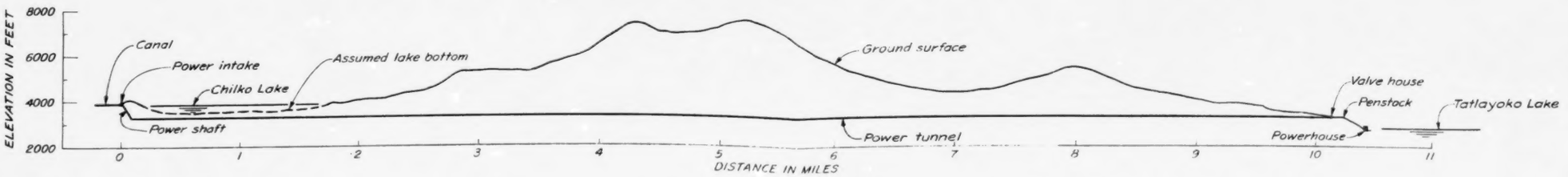
Scale: A 200 0 200 400 600 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

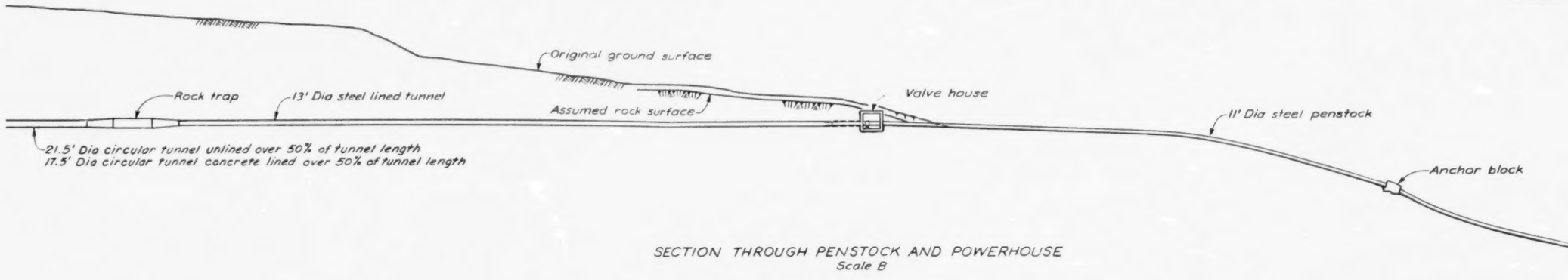
HOMATHKO DEVELOPMENT OVERVIEW STUDY

TASEKO - TATLAYOKO DIVERSION NEMAIA DAM PLAN, ELEVATION AND SECTIONS

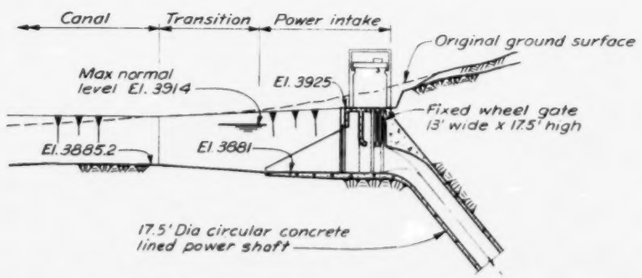
DATE	JUN 1981	PLATE 11-5	R
DWN	K.L.	DWG No.	704 - C14 - D17



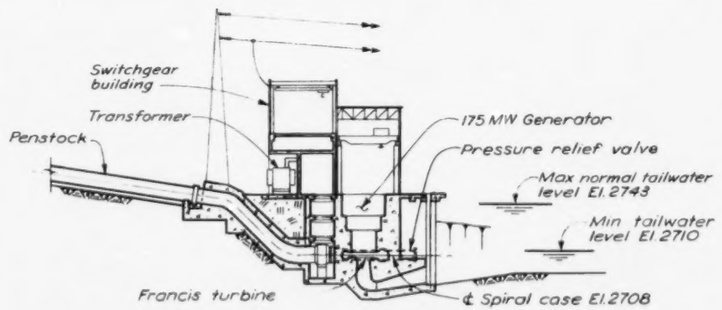
SECTION ALONG ℄ POWER WORKS


Original ground surface
Rock trap
13' Dia steel lined tunnel
Assumed rock surface
Valve house
11' Dia steel penstock
21.5' Dia circular tunnel unlined over 50% of tunnel length
17.5' Dia circular tunnel concrete lined over 50% of tunnel length
Anchor block

SECTION THROUGH PENSTOCK AND POWERHOUSE
Scale B



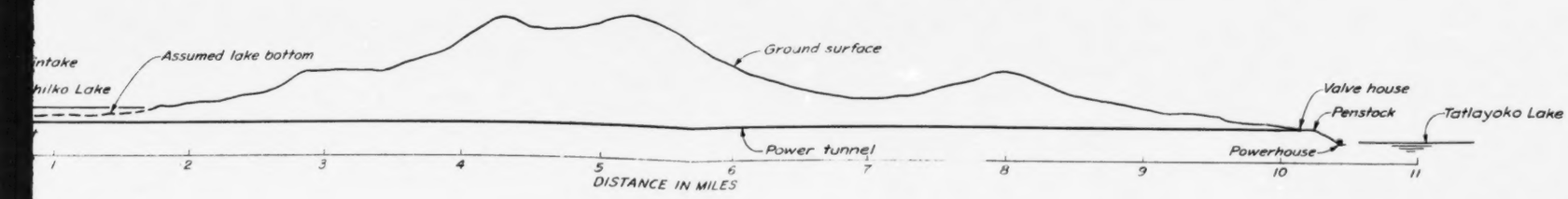
SECTION THROUGH POWER INTAKE
Scale A



SECTION THROUGH POWERHOUSE
Scale A

ITEM
ENGINEERING & ENVIRONMENTAL INVESTIGATIONS & ASSESSEMENT
FIRST CONTRACT AWARE
FINAL DESIGN
ACCESS IMPROVEMENTS
TASEKO DAM: RESERVOIR
DIVERSION
EARTHFILL DAMS
SPILLWAY
INTAKE
WATER SUPPLY TUNNEL
ELKIN POOL
CANALS
NEMAIA DAM: DAM
SPILLWAY
CANAL INTAKE
SIDE SPILLWAY
POWER TUNNEL INTAKE
POWER TUNNEL
PENSTOCK
POWERHOUSE

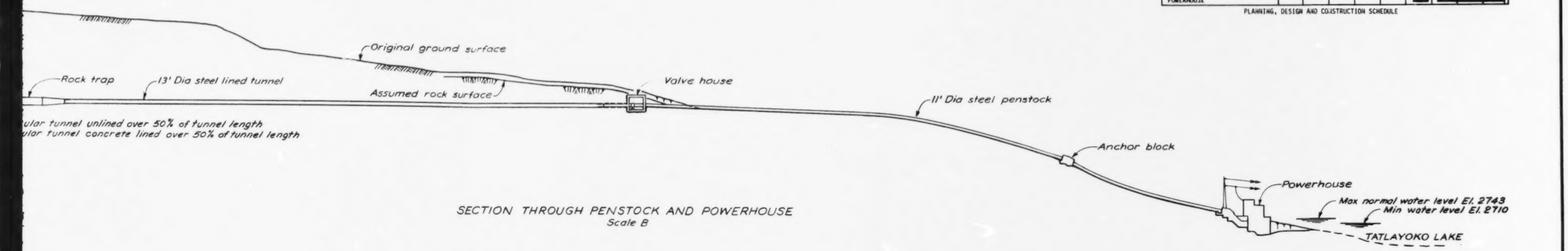
PLANNIN



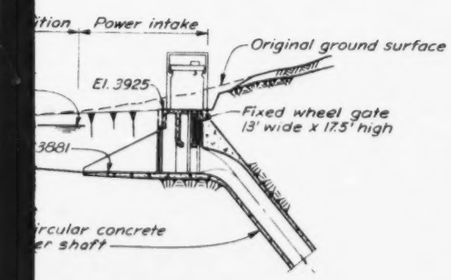
SECTION ALONG ℄ POWER WORKS

ITEM	CALENDAR YEARS TO FIRST IN-SERVICE									
				?	1	2	3	4	5	
ENGINEERING & ENVIRONMENTAL INVESTIGATIONS & ASSESSMENT						TASEKO-TATLAYOKO DIVERSION, TATLAYOKO LAKE STORAGE & NUDE CANYON DEVELOPMENTS				BEGIN DIVERSION TUNNEL CLOSURE
FIRST CONTRACT AWARE					PROJECT APPROVAL					UNIT IN SERVICE
FINAL DESIGN										
ACCESS IMPROVEMENTS										
TASEKO DAM: RESERVOIR										
DIVERSION										
EARTHFILL DAMS										
SPILLWAY										
INTAKE										
WATER SUPPLY TUNNEL										
ELKIN POOL										
CANALS										
NEMAIA DAM: DAM										
SPILLWAY										
CANAL INTAKE										
SIDE SPILLWAY										
POWER TUNNEL INTAKE										
POWER TUNNEL										
PENSTOCK										
POWERHOUSE										

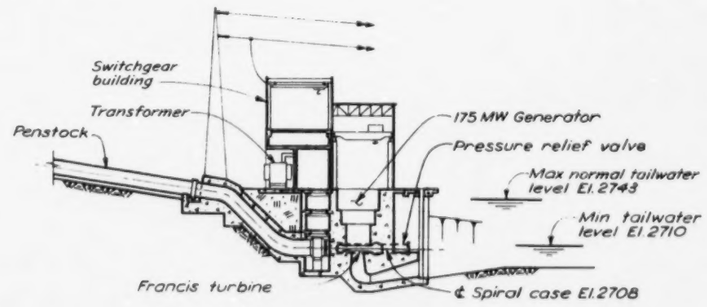
PLANNING, DESIGN AND CONSTRUCTION SCHEDULE


Original ground surface
Rock trap
13' Dia steel lined tunnel
Assumed rock surface
Valve house
11' Dia steel penstock
ular tunnel unlined over 50% of tunnel length
ular tunnel concrete lined over 50% of tunnel length
Anchor block
Powerhouse
Max normal water level El. 2743
Min water level El. 2710
TATLAYOKO LAKE

SECTION THROUGH PENSTOCK AND POWERHOUSE
Scale B



ROUGH POWER INTAKE
Scale A



SECTION THROUGH POWERHOUSE
Scale A

Scale: B 200 0 200 400 600 Feet

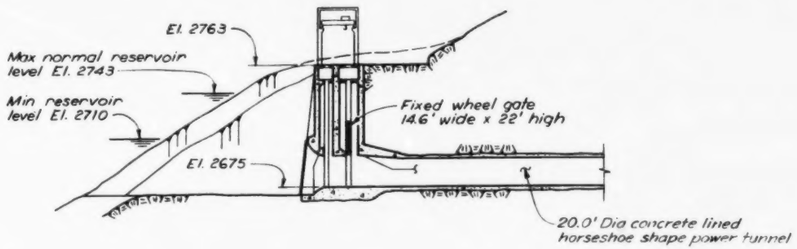
Scale: A 50 0 50 100 150 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

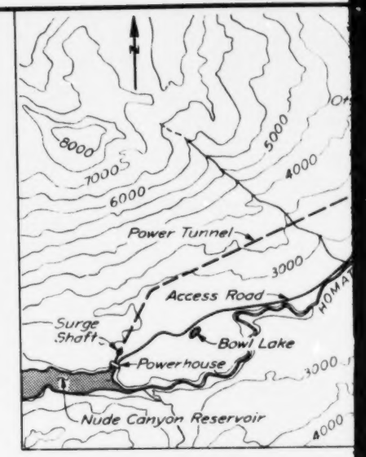
HOMATHKO DEVELOPMENT OVERVIEW STUDY

TASEKO - TATLAYOKO DIVERSION POWER FACILITIES SECTIONS

DATE	PLATE 11-6	R
JUN 1981		
DWN K.L.	DWG No. 704 - C14 - U18	


El. 2763
Max normal reservoir level El. 2743
Min reservoir level El. 2710
El. 2675
Fixed wheel gate 14.6' wide x 22' high
20.0' Dia concrete lined horseshoe shape power tunnel

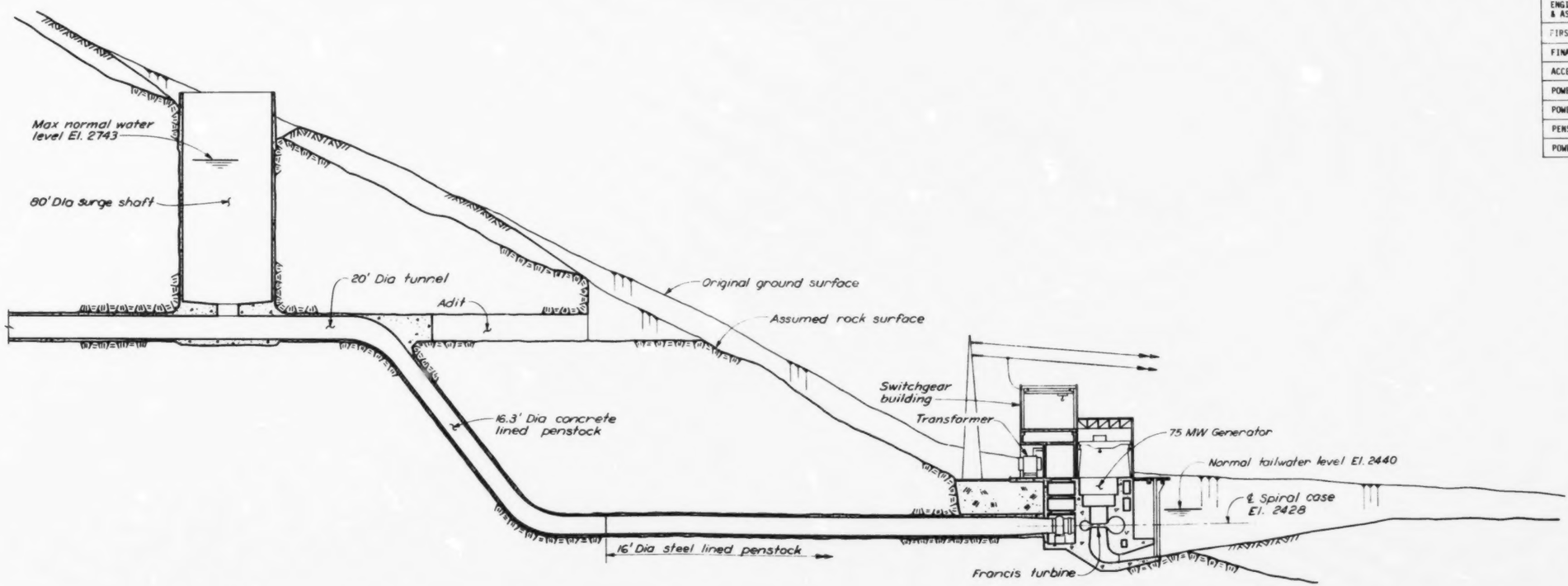
SECTION THROUGH POWER INTAKE
Scale A



LOCAT
Sc

ITEM	CALE
ENGINEERING INVESTIGATIONS & ASSESSMENT	
FIRST CONTRACT	
FINAL DESIGN	
ACCESS	
POWER INTAKE	
POWER TUNNEL	
PENSTOCK	
POWERPLANT	

PLANNING, DESIGN AND CONST



SECTION THROUGH TUNNEL, PENSTOCK & POWERHOUSE
Scale A

Scale: B 1

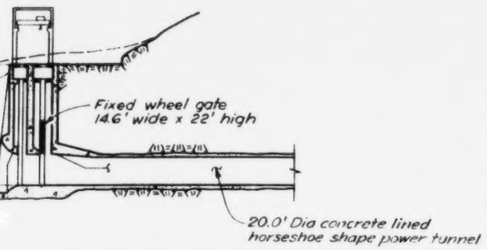
Scale: A 30

BRITISH

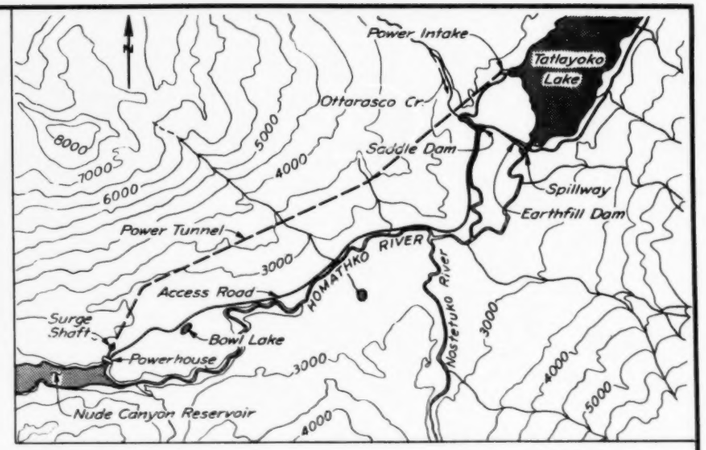
HOMATHKO D
BOWL LA
POWER FA
SECTIONS

DATE JUN 1

DWN DS



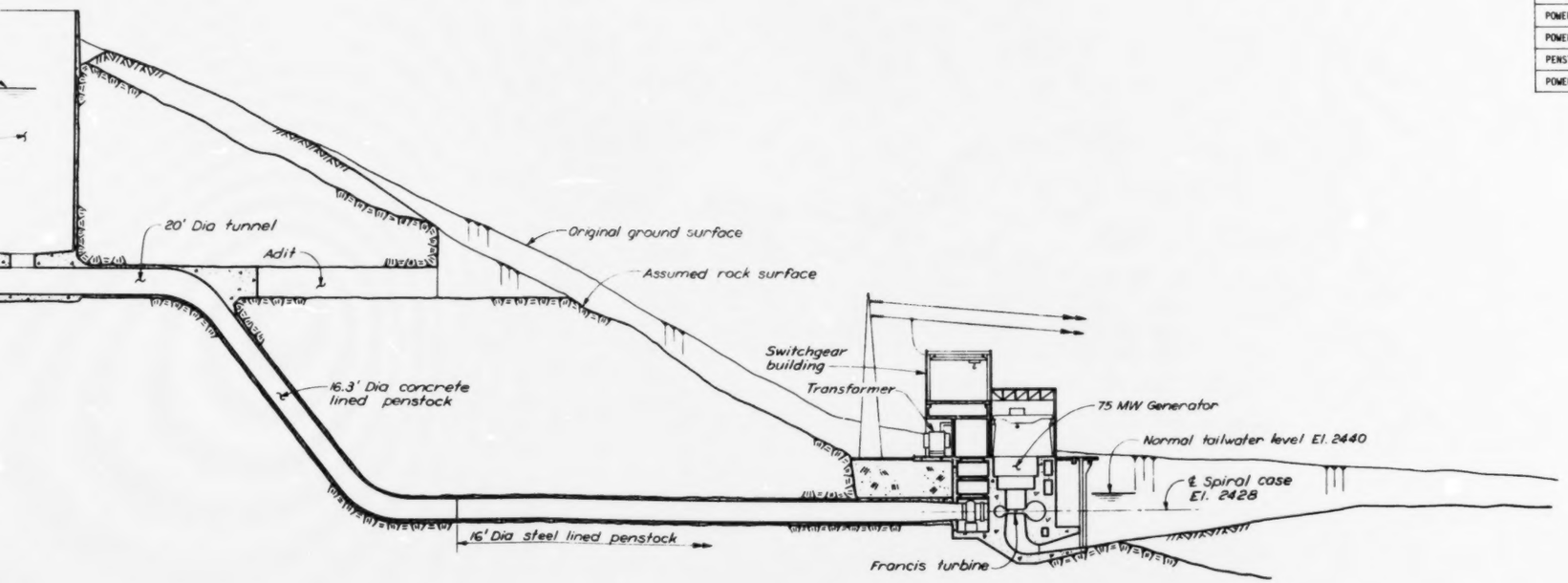
OUGH POWER INTAKE
Scale A



LOCATION PLAN
Scale B

ITEM	CALENDAR YEARS TO FIRST IN-SERVICE									
					1	2	3	4	5	
ENGINEERING INVESTIGATIONS & ASSESSMENT					PROJECT APPROVAL					UNIT IN SERVICE
FIRST CONTRACT AWARD					△					
FINAL DESIGN										
ACCESS										
POWER INTAKE										
POWER TUNNEL										
PENSTOCK										
POWERPLANT										

PLANNING, DESIGN AND CONSTRUCTION SCHEDULE



SECTION THROUGH TUNNEL, PENSTOCK & POWERHOUSE
Scale A

Scale: B 1 0 1 2 Miles

Scale: A 50 0 50 100 150 Feet

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HOMATHKO DEVELOPMENT OVERVIEW STUDY

BOWL LAKE PROJECT
POWER FACILITIES
SECTIONS

DATE	JUN 1981	PLATE 12-1	R
DWN	DS	DWG No. 704 - C14 - U19	

POOR

QUALITY

ORIGINAL